US 20170148396A1

(19) United States
(12) Patent Application Publication
CHEN et al.
(10) Pub. No.: US 2017/0148396 A1
(43) Pub. Date: May 25, 2017

(54) LIQUID CRYSTAL PANEL AND DRIVING METHOD THEREOF

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(21) Appl. No.: **14/781,133**

(22) PCT Filed: **Aug. 12, 2015**

(86) PCT No.: **PCT/CN2015/086786**

§ 371 (c)(1),
(2) Date: **Sep. 29, 2015**

(30) **Foreign Application Priority Data**

Jun. 12, 2015 (CN) 201510326020.2

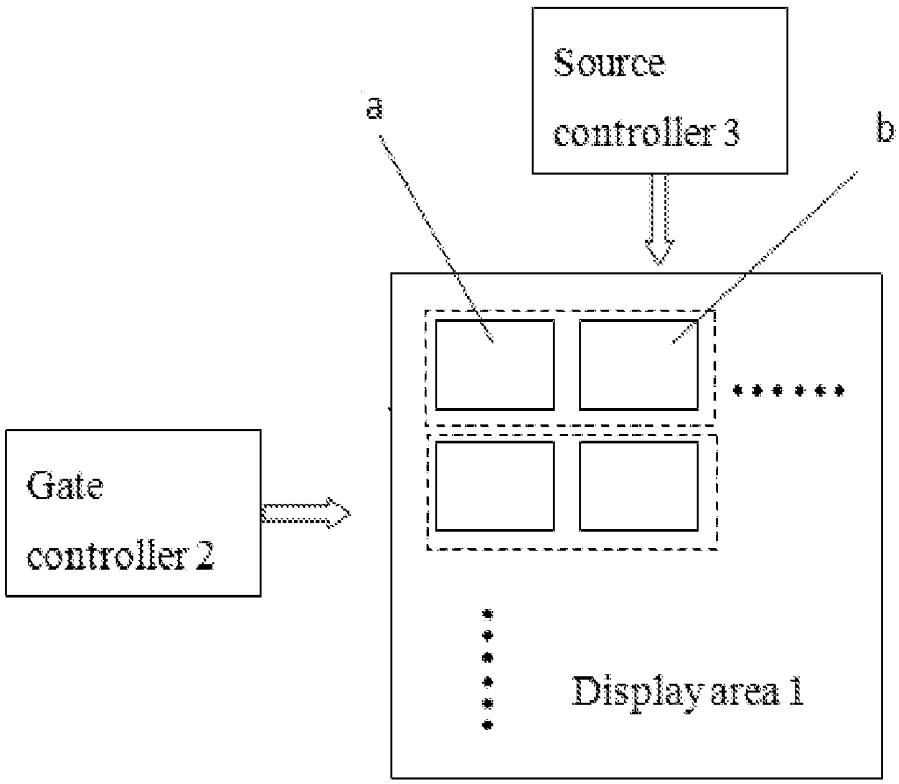
Publication Classification

(51) **Int. Cl.**
G09G 3/36 (2006.01)
G09G 3/20 (2006.01)

(52) **U.S. Cl.**
CPC ***G09G 3/3607*** (2013.01); ***G09G 3/2003*** (2013.01); *G09G 2300/0443* (2013.01); *G09G 2320/0242* (2013.01); *G09G 2300/0452* (2013.01); *G09G 2320/0673* (2013.01); *G09G 2320/0633* (2013.01)

(57) **ABSTRACT**

A liquid crystal panel including a plurality of pixel units, each including sub-pixel units of a plurality of colors, the sub-pixel units included in the liquid crystal panel includes a main pixel area and a secondary pixel area. The driving method includes: acquiring a grayscale value of a picture to be displayed of each of the partial sub-pixel units; searching for a main grayscale value and a secondary grayscale value corresponding to the grayscale value of the picture to be displayed of the each of the partial sub-pixel units from a corresponding relationship between grayscale values of a color of each of the partial sub-pixel units and the main grayscale values and the secondary grayscale values; and providing the searched main grayscale value and the secondary grayscale value to areas of the main pixel unit and the secondary pixel unit of the each of the partial sub-pixel units respectively.



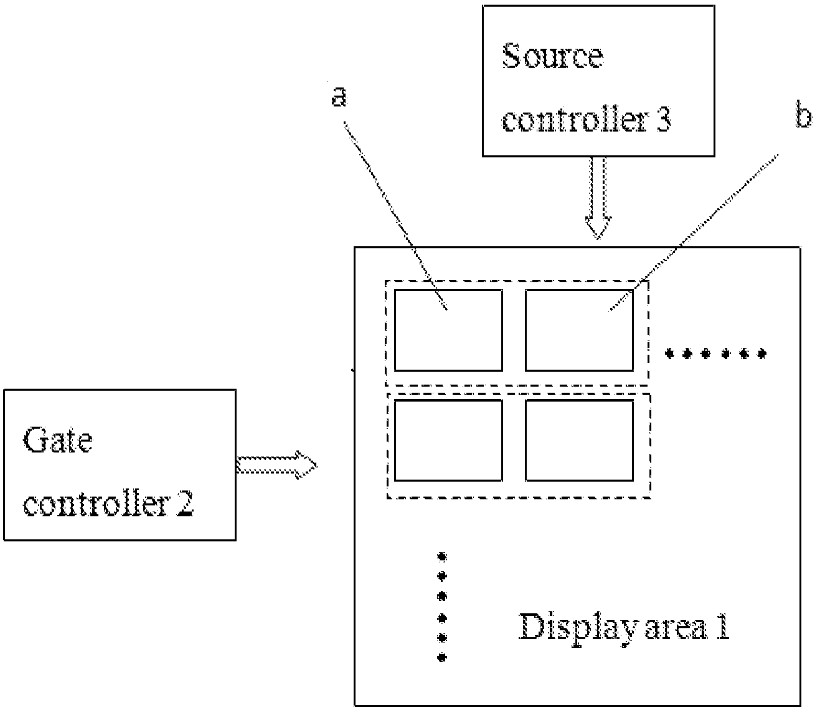

Source controller 3
a
b
Gate controller 2
Display area 1

FIG. 1

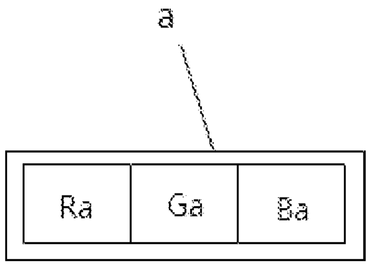
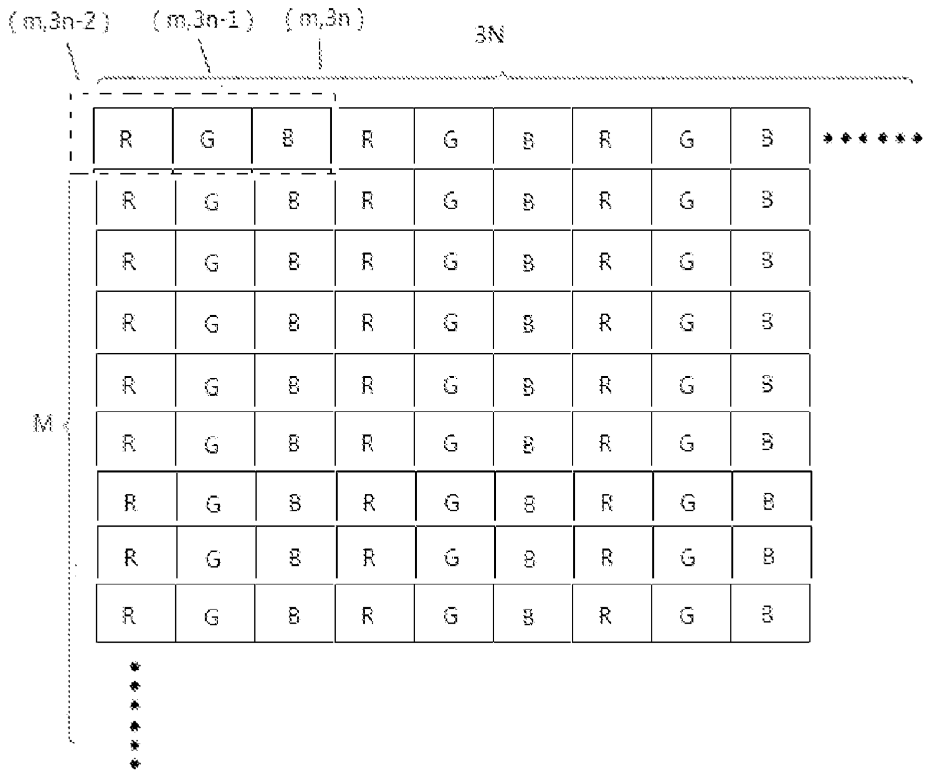

a
Ra
Ga
Ba

FIG. 2


(m,3n-2)
(m,3n-1)
(m,3n)
3N
M
R G B R G B R G B
R G B R G B R G B
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R G B R G B R G B
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R G B R G B R G B

FIG. 3

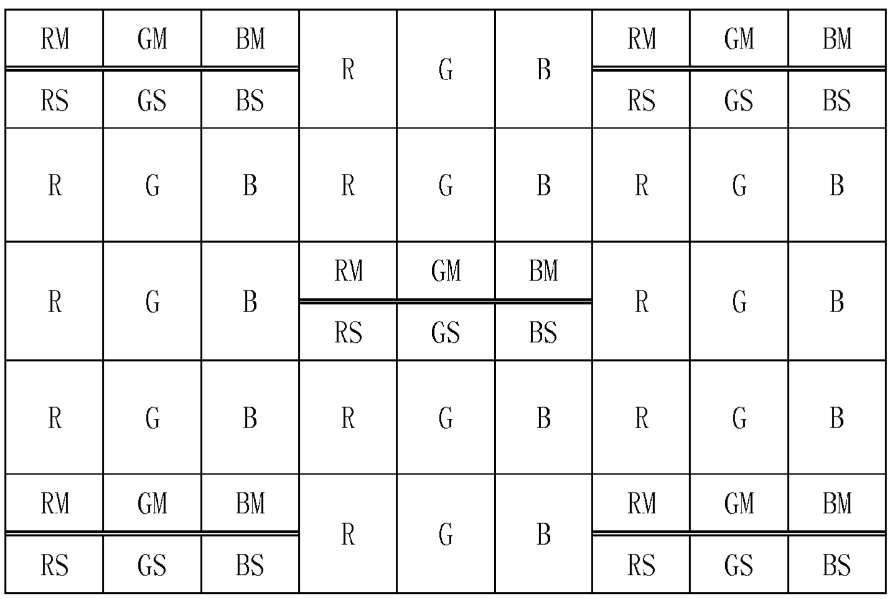
RM GM BM R G B RM GM BM
RS GS BS RS GS BS
R G B R G B R G B
R G B RM GM BM R G B
RS GS BS
R G B R G B R G B
RM GM BM R G B RM GM BM
RS GS BS RS GS BS

FIG. 4

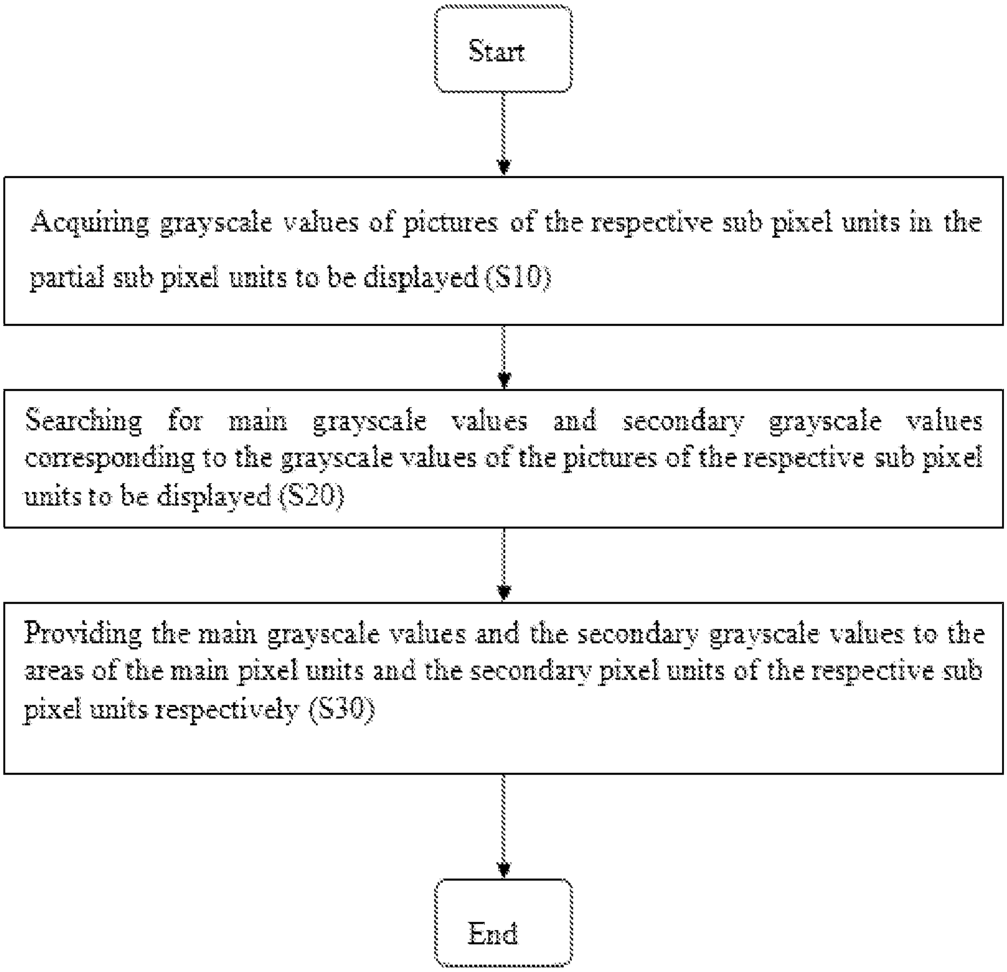
Start
Acquiring grayscale values of pictures of the respective sub pixel units in the partial sub pixel units to be displayed (S10)
Searching for main grayscale values and secondary grayscale values corresponding to the grayscale values of the pictures of the respective sub pixel units to be displayed (S20)
Providing the main grayscale values and the secondary grayscale values to the areas of the main pixel units and the secondary pixel units of the respective sub pixel units respectively (S30)
End

FIG. 5

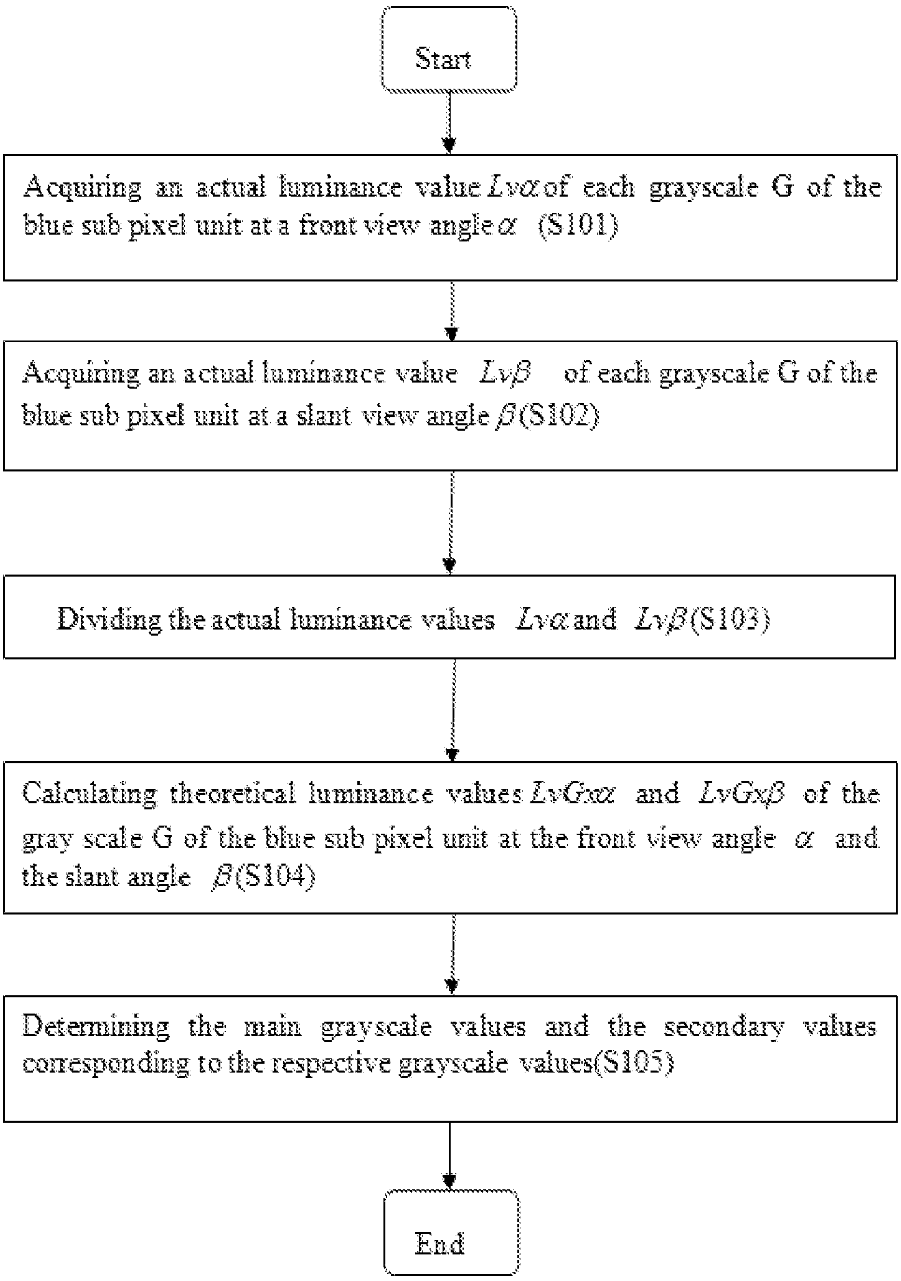
Start
Acquiring an actual luminance value $Lv\alpha$ of each grayscale G of the blue sub pixel unit at a front view angle α (S101)
Acquiring an actual luminance value $Lv\beta$ of each grayscale G of the blue sub pixel unit at a slant view angle β (S102)
Dividing the actual luminance values $Lv\alpha$ and $Lv\beta$ (S103)
Calculating theoretical luminance values $LvGx\alpha$ and $LvGx\beta$ of the gray scale G of the blue sub pixel unit at the front view angle α and the slant angle β (S104)
Determining the main grayscale values and the secondary values corresponding to the respective grayscale values(S105)
End

FIG. 6

LIQUID CRYSTAL PANEL AND DRIVING METHOD THEREOF

TECHNICAL FIELD

[0001] The present invention generally relates to a technical field of a liquid crystal display, and more particularly to a liquid crystal panel and a driving method thereof.

BACKGROUND ART

[0002] A liquid crystal display (LCD) is a flat and ultra-thin display apparatus, which is composed of a certain amount of color or black-and-white pixels and disposed in front of a light source or a reflection plate. Power consumption of the liquid crystal display is very low, and the liquid crystal display has characteristics such as high image quality, small volume and low weight, which is accordingly highly appreciated and becomes a mainstream of displays. The liquid crystal display has been widely applied to electronic products, such as a computer apparatus, a mobile phone or a digital photo frame having a display screen etc., and a wide view angle technology is one of the development emphases of current liquid crystal displays. However, when a side view angle or a slant view angle is excessively large, a color shift phenomenon generally occurs in a wide view angle liquid crystal display.

[0003] As for a problem that color shift occurs in a wide view angle liquid crystal display, a 2D1G technology is adopted in current industry to solve the problem. The so-called 2D1G technology indicates that each of pixel units is divided into a main pixel area and a sub pixel area having different areas in a liquid crystal panel, the main pixel area and the sub pixel area in the same one pixel unit are connected to different data lines and same gate lines. Different display luminance and slant view luminance are generated through inputting different data signals (different grayscale values) to the main pixel area and the sub pixel area so as to reduce color shift generated during side viewing or slant viewing. However, after each pixel unit is divided into the main pixel area and the sub pixel area, a number of the data lines for inputting data signals will be twice the original number, which may greatly reduce open ratio of the liquid crystal panel, affect penetration rate, and reduce display quality of the liquid display panel.

SUMMARY

[0004] To this end, the purpose of the present invention is to provide a liquid crystal panel and a driving method thereof, color shift during side viewing or slant viewing is reduced by changing the driving method of the liquid crystal panel so as to reduce effect on penetration rate. In addition, the problem that skin color is slanted to yellow and green produced by simply dividing the entire blue sub pixel units into main pixel areas and sub pixel areas is also overcome.

[0005] According to one aspect of an exemplary embodiment of the present invention, a driving method of a liquid crystal panel is provided, the liquid crystal panel including a plurality of pixel units, wherein, each of the pixel units comprises sub pixel units of a plurality of colors, wherein, each of partial sub pixel units among sub pixel units of a part or all of the plurality of colors among all sub pixel units included in the liquid crystal panel includes a main pixel area and a secondary pixel area, the driving method comprises: acquiring a grayscale value of a picture to be displayed of each of the partial sub pixel units; searching for a main grayscale value and a secondary grayscale value corresponding to the grayscale value of the picture to be displayed of the each of the partial sub pixel units from a corresponding relationship between grayscale values of a color of each of the partial sub pixel units and the main grayscale values and the secondary grayscale values; and providing the searched main grayscale value and the secondary grayscale value to areas of the main pixel unit and the secondary pixel unit of the each of the partial sub pixel units respectively.

[0006] Each of all sub pixel units in partial pixel units may include the main pixel area and the secondary pixel area, and all the sub pixel units in the other partial pixel units do not include the main pixel area and the secondary pixel area.

[0007] The sub pixel units in the partial pixel units may be not adjacent.

[0008] The corresponding relationship between the grayscale values of each of the colors and the main grayscale values and the secondary grayscale values may satisfy the following conditions: in an order of magnitudes of the grayscale values of any one color, respectively providing the main grayscale values and the secondary grayscale values corresponding to the grayscale values to the main pixel areas and the secondary pixel areas of the sub pixel units of the any one color among the partial sub pixel units in sequence, and a relation curve graph between the grayscale values and luminances of the sub pixel units of the any one color at the slant angle β is same as or similar to a predetermined gamma (γ) curve.

[0009] The corresponding relationship between the grayscale values of the any one color and the main grayscale values and secondary grayscale values may be acquired from the following steps:

[0010] **S101**, acquiring an actual luminance value $Lv\alpha$ of each grayscale G of a sub pixel unit of the any one color of the liquid crystal panel at a front view angle α;

[0011] **S102**, acquiring an actual luminance value $Lv\beta$ of each grayscale G of the sub pixel unit of the any one color of the liquid crystal panel at a slant view angle β;

[0012] **S103**, according to an area ratio of a:b of the main pixel area and the secondary pixel area of the sub pixel unit of the any one color, dividing the actual luminance value $Lv\alpha$ into actual values $LvM\alpha$ and $LvS\beta$ of each grayscale G of the main pixel area and the secondary pixel area at the front view angle α, dividing the actual luminance value $Lv\beta$ into actual values $LvM\beta$ and $LvS\beta$ of each grayscale G of the main pixel area and the secondary pixel area at the slant view angle β according to the following equations:

$$LvM\alpha : LvS\alpha = a:b,\ LvM\alpha + LvS\alpha = Lv\alpha;$$

$$LvM\beta : LvS\beta = a:b,\ LvM\beta + LvS\beta = Lv\beta;$$

[0013] **S104**: calculating theoretical luminance values $LvGx\alpha$ and $LvGx\beta$ of the gray scale G of the sub pixel unit of the any one color of the liquid crystal panel at the front view angle α and the slant angle β according to the actual luminance values $Lv\alpha(max)$ and $Lv\beta(max)$ of a highest grayscale max acquired in steps **S101** and **S102**, in conjunction with a equation of the predetermined gamma (γ) curve and

$$\left(\frac{G}{\max}\right)^{\gamma} = \frac{LvG}{Lv(\mathrm{Max})};$$

[0014] S**105**, determining the main grayscale value and the secondary value corresponding to each of grayscale values of the any one color, wherein, as for any one grayscale value Gx, following equations are calculated according to the actual luminance values LvMα, LvMβ, LvSα and LvSβ obtained in the result of the above step S**103** and the theoretical luminance values LvGxα and LvGxβ obtained in the result of the above step S**104**:

$$\Delta 1 = LvM\alpha + LvS\alpha - LvGx\alpha;\ \Delta 2 = LvM\beta + LvS\beta - LvGx\beta;$$
$$\gamma = \Delta 1^2 + \Delta 2^2;$$

[0015] when y is minimal, corresponding grayscale values Gmx and Gsx are set to be the main grayscale value and the secondary grayscale value corresponding to the any one grayscale value Gx.

[0016] The step S**101** may comprise:

[0017] measuring the gamma (γ) curve of the sub pixel unit of the any one color at the front view angle α directly; and

[0018] determining the actual luminance value Lvα according to the gamma (γ) curve.

[0019] The step S**102** may comprise:

[0020] measuring the gamma (γ) curve of the sub pixel unit of the any one color at the slant view angle β directly; and

[0021] determining the actual luminance value Lvβ according to the gamma (γ) curve.

[0022] The front view angle α may be 0°, and the squint angle β may be 30°-80°.

[0023] According to another aspect of an exemplary embodiment of the present invention, it is provided a liquid crystal panel, comprising a gate controller, a source controller and a plurality of pixel units, each of the pixel units comprising sub pixel units of a plurality of colors, wherein, each of partial sub pixel units among sub pixel units of a part or all of the plurality of colors among all sub pixel units included in the liquid crystal panel includes a main pixel area and a secondary pixel area; as for any one sub pixel unit in the partial sub pixel units, the gate controller provides scanning signals to the main pixel area and the secondary pixel area of the any one sub pixel unit through the same scanning line, and the source controller provides data signals to the main pixel area and the secondary pixel area of the any one sub pixel unit through different data lines.

[0024] According to the liquid crystal panel and the driving method thereof provided by the exemplary embodiment, partial sub pixel units in a traditional RGB three-pixel liquid crystal panel is set to include two different main pixel area and secondary pixel area, data parameters are re-set, the main pixel area and the secondary pixel area are connected to data signal lines respectively, and different grayscale values are input to the main pixel area and the secondary pixel area, so as to solve color shift problem generated in a case of a wide view, and reduce effect on penetration rate; moreover, the problem that skin color is slanted to yellow and green produced by simply setting the entire blue sub pixel units to include main pixel area and sub pixel area is also overcome.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The above and other targets, features and advantages of exemplary embodiments of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings in which:

[0026] FIG. **1** is a structure diagram of a liquid crystal panel according to an exemplary embodiment of the present invention.

[0027] FIG. **2** is a structure diagram of a pixel unit in the liquid crystal panel according to an exemplary embodiment of the present invention.

[0028] FIG. **3** is a diagram of an array of sub pixel units in a liquid crystal panel according to an exemplary embodiment of the present invention.

[0029] FIG. **4** is a diagram of a combination of partial sub pixel units according to an exemplary embodiment of the present invention.

[0030] FIG. **5** is a flowchart of a driving method of a liquid crystal panel according to an exemplary embodiment of the present invention.

[0031] FIG. **6** is a flowchart of a step of obtaining a corresponding relationship between a blue grayscale value and a main grayscale value and a secondary grayscale value according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0032] Here a detailed reference will be made to exemplary embodiments of the present invention, in which the examples are shown in the drawings and the same drawing reference marks always indicate the same component. Embodiments of the present invention will be described in detail below by referring to the accompany drawings.

[0033] FIG. **1** is a structure diagram of a liquid crystal panel according to an exemplary embodiment of the present invention. As shown in FIG. **1**, a liquid crystal panel mainly includes a display area **1** having a plurality of pixel units a and b, a gate controller **2** and a source controller **3**, wherein the gate controller **2** provides scanning signals to the pixel units a and b through a plurality of scanning lines, and the source controller **3** provides data signals to the pixel units a and b through a plurality of data lines.

[0034] Each of the pixel units includes sub pixel units of a plurality of colors. Among all the sub pixel units included in the liquid crystal panel, each of partial sub pixel units among (i.e. each of a part of) the sub pixel units of partial colors or all colors include a main pixel area and a secondary pixel area; as for any one sub pixel unit among the partial sub pixel units, the gate controller provides scanning signals to the main pixel area and the secondary pixel area of the any one sub pixel unit through the same scanning line, and the source controller provides data signals to the main pixel area and the secondary pixel area of the any one sub pixel unit through different data lines. Here, each pixel unit can include at least one of following units: a red sub pixel unit, a green sub pixel unit, a blue sub pixel unit and sub pixel units of other colors. As shown in the diagram of a pixel unit in the liquid crystal panel according to an exemplary embodiment of the present invention shown in FIG. **2**, each pixel unit a can include a red sub pixel unit Ra, a green sub pixel unit Ga and a blue sub pixel unit Ba.

[0035] FIG. 3 is a diagram of an array of sub pixel units in a liquid crystal panel according to an exemplary embodiment of the present invention. As shown in FIG. 3, the liquid crystal panel includes pixel units of M (line)×N(column), wherein, M and N are positive integers greater than 1, each pixel unit is composed of the red sub pixel unit, the green sub pixel unit and the blue sub pixel unit, and the liquid crystal panel includes an array of sub pixel units of M (line)×3N(column). In the array of the sub pixel units, the (m, 3n−2)-th sub pixel unit indicates a red sub pixel unit R, the (m, 3n−1)-th sub pixel unit indicates a green sub pixel unit G, the (m, 3n)-th sub pixel unit indicates a blue sub pixel unit B, wherein $m \in [1, 2, 3, \ldots, M]$, and $n \in [1, 2, 3, \ldots, N]$.

[0036] Here, the partial sub pixel units among the sub pixel units of the partial colors or the all colors indicate partial sub pixel units among the sub pixel units of each of the partial colors or the all colors, which can solve the problem that skin color is slanted to yellow and green produced by simply setting the entire blue sub pixel units to include main pixel units and sub pixel units. For example, in the case where the partial colors are red and blue, the partial sub pixel units among the sub pixel units of the partial colors include partial sub pixel units among the red sub pixel units and partial sub pixel units among the blue sub pixel units. Here, the main pixel area and the secondary pixel area included in the partial sub pixel units can be formed through a division in a form of black matrix, and also can formed through a division by opaque metal wires.

[0037] A combination of the above partial sub pixel units may have many forms. FIG. 4 is a diagram of a combination of the divided partial sub pixel units according to an exemplary embodiment of the present invention. As shown in FIG. 4, partial sub pixel units among the red sub pixel units include a main pixel area RM and a red secondary pixel area RS, partial sub pixel units among the blue sub pixel units include a main pixel area BM and a secondary pixel area BS, and partial sub pixel units among the green sub pixel units are divided into a main pixel area GM and a secondary pixel area GS. The sub pixel units of the various colors among the partial sub pixel units are mutually combined to constitute a plurality of pixel units. That is to say, any one sub pixel unit among the sub pixel units of any one color among the partial sub pixel units and the sub pixel unit among the sub pixel units of other colors among the partial sub pixel units constitute a pixel unit. That is to say, all the sub pixel units in the partial pixel units (which include the red sub pixel unit, the green sub pixel unit and the blue sub pixel unit) include the main pixel unit and the secondary pixel unit, and all the sub pixel units in the other pixel units do not include the main pixel unit and the secondary pixel unit. As shown in FIG. 4, the partial pixel units are not adjacent, so as to solve the problems of penetration rate and color shift. Those skilled in the art can understand that the combination of the divided partial sub pixel units according to an exemplary embodiment of the present invention is not limited to the form shown in FIG. 4.

[0038] FIG. 5 is a flowchart of a driving method of a liquid crystal panel according to an exemplary embodiment of the present invention.

[0039] Referring to FIG. 5, in step S10, a grayscale value of a picture to be displayed of each of the partial sub pixel units is acquired.

[0040] In step S20, a main grayscale value and a secondary grayscale value corresponding to the grayscale value of the picture to be displayed of each of the partial sub pixel units are searched from a corresponding relationship between grayscale values of a color of each of the partial sub pixel units and the main grayscale values and the secondary grayscale values. That is to say, as for a sub pixel unit of any one color, the main grayscale value and the secondary grayscale value corresponding to the grayscale value of the picture to be displayed of the sub pixel unit are searched from the corresponding relationship between the grayscale values of the any one color and the main grayscale values and the secondary grayscale values.

[0041] Here, the corresponding relationship between the grayscale values of each of the colors and the main grayscale values and the secondary grayscale values satisfy the following conditions: in an order of magnitudes of the grayscale values of any one color, respectively providing the main grayscale values and the secondary grayscale values corresponding to the grayscale values to the main pixel areas and the secondary pixel areas of the sub pixel units of the any one color among the partial sub pixel units in sequence, and a relation curve graph between the grayscale values and luminances of the sub pixel units of the any one color at the slant angle β is same as or similar to a predetermined gamma (γ) curve.

[0042] Here, the Gamma (γ) curve can be determined according to a practical requirement of the liquid crystal panel, and a value range of γ may be 1.8 to 2.4. A range of the slant view angle β is 30° to 80°.

[0043] Below, a step of obtaining a corresponding relationship between a blue grayscale value and a main grayscale value and a secondary grayscale value will be taken as an example in conjunction with FIG. 6 to explain the step of obtaining the corresponding relationship between the grayscale value and the main grayscale value and the secondary grayscale value of the respective colors in detail.

[0044] FIG. 6 is a flowchart of a step of obtaining a corresponding relationship between a blue grayscale value and a main grayscale value and a secondary grayscale value according to an exemplary embodiment of the present invention.

[0045] Referring to FIG. 6, in step S101, an actual luminance value $Lv\alpha$ of each grayscale G of the blue sub pixel unit of the liquid crystal panel at a front view angle α is acquired. Here, the front view α may be 0°. Wherein, the grayscale of the liquid crystal panel includes 256 grayscale values from 0 to 255. In step S101, the actual luminance value $Lv\alpha$ may be acquired through various proper manners. For example, a gamma (γ) curve of the blue sub pixel unit at the front view angle α is directly measured and the actual luminance value $Lv\alpha$ can be determined from the gamma (γ) curve.

[0046] In step S102, an actual luminance value $Lv\beta$ of each grayscale G of the blue sub pixel unit of the liquid crystal panel at a slant view angle β is acquired. In step S102, the actual luminance value $Lv\beta$ may be acquired through various proper manners. For example, a gamma (γ) curve of the blue sub pixel unit at the front view angle β is directly measured and the actual luminance value $Lv\beta$ may be determined from the gamma (γ) curve.

[0047] In step S103, according to an area ratio of a:b of the main pixel area and the secondary pixel area of the blue sub pixel unit, the actual luminance values $Lv\alpha$ and $Lv\beta$ are divided according to following equations, that is to say, the actual luminance value $Lv\alpha$ is divided into actual values

$LvM\alpha$ and $LvS\beta$ of each grayscale G of the main pixel area and the secondary pixel area at the front view angle α, and the actual luminance value $Lv\beta$ is divided into actual values $LvM\beta$ and $LvS\beta$ of each grayscale G of the main pixel area and the secondary pixel area at the slant view angle β according to the following equations:

$$LvM\alpha: LvS\alpha=a:b,\ LvM\alpha+LvS\alpha=Lv\alpha;$$

$$LvM\beta: LvS\beta=a:b,\ LvM\beta+LvS\beta=Lv\beta;$$

[0048] In step **S104**, theoretical luminance values $LvGx\alpha$ and $LvGx\beta$ of the gray scale G of the blue sub pixel unit of the liquid crystal panel at the front view angle α and the slant angle β are calculated according to the actual luminance values $Lv\alpha B(max)$ and $Lv\beta B(max)$ of a highest grayscale max acquired in steps **S101** and **S102**, in conjunction with a equation of the predetermined gamma (γ) curve and

$$\left(\frac{G}{\max}\right)^{\gamma}=\frac{LvG}{Lv(\mathrm{Max})}.$$

[0049] In step **S105**, the main grayscale value and the secondary value corresponding to the respective blue grayscale values are determined, wherein, as for any one grayscale value Gx, following equations are calculated according to the actual luminance values $LvM\alpha$, $LvM\beta$, $LvS\alpha$ and $LvS\beta$ obtained in the result of the above step **S103** and the theoretical luminance values $LvGx\alpha$ and $LvGx\beta$ obtained in the result of the above step **S104**:

$$\Delta 1=LvM\alpha+LvS\alpha-LvGx\alpha;\ \Delta 2=LvM\beta+LvS\beta-LvGx\beta;$$
$$y=\Delta 1^2+\Delta 2^2;$$

[0050] Corresponding grayscale values Gmx and Gsx, when y is minimal, are set to be the main grayscale value and the secondary grayscale value corresponding to the any one grayscale value Gx, respectively.

[0051] In addition, based on the same manner, the corresponding relationships between the grayscale values of the other colors and the main grayscale values and the secondary grayscale values are acquired, which will be omitted herein.

[0052] Those skilled in the art will understand that, the manner of acquiring the above corresponding relationship is not limited to the manner shown in FIG. **6**, and the above corresponding relationship also can be acquired through the other proper manners.

[0053] Referring to FIG. **5** again, in step S30, the searched main grayscale values and secondary grayscale values are provided to the areas of the main pixel units and the secondary pixel units of the respective sub pixel units respectively. That is to say, the main grayscale values and the secondary grayscale values corresponding to the grayscale values of the pictures to be displayed of the respective sub pixel units are provided to the areas of the main pixel units and the secondary pixel units of the respective sub pixel units among partial sub pixel units respectively.

[0054] Those skilled in the art will understand that, the other sub pixel units which do not include the main pixel unit and the secondary unit in the liquid crystal panel may be driven according to the driving methods in the prior art, that is, the grayscale values of the pictures to be displayed of the sub pixel units are provided to the sub pixel units.

[0055] According to the liquid crystal panel and the driving method thereof provided by the exemplary embodiment, partial sub pixel units in a traditional RGB three-pixel liquid crystal panel is configured to include two different main pixel area and secondary pixel area, data parameters are re-set, the main pixel area and the secondary pixel area are connected to data signal lines respectively, and different grayscale values are input to the main pixel area and the secondary pixel area, so as to solve color shift problem generated in a case of a wide view, and reduce effect on penetration rate; moreover, the problem that skin color is slanted to yellow and green produced by simply configuring the all blue sub pixel units to include main pixel area and sub pixel area is also overcome.

[0056] In addition, it should be understood that, the driving method of the liquid crystal panel according to the exemplary embodiment of the present invention may be embodied as computer readable codes on a computer readable recording medium. The computer readable recording medium is any data storage device that can store data which can be thereafter read by a computer system. Examples of the computer readable recording medium include: a Read-Only Memory

[0057] (ROM), a Random-Access Memory (RAM), a CD-ROM, a magnetic tape, a floppy disk, an optical data storage device and a carrier wave (such as a data transmission passing through a network via a wired or wireless transmission path). The computer readable recording medium also can be distributed in the computer system that is connected to the network, so that the computer readable codes are stored and performed in a distribution manner. In addition, function programs, codes and code segments implementing the present invention may be easily construed by ordinary programmers in the field related to the present invention within the range of the present invention.

[0058] Although the present invention has been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in forms and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

1. A driving method of a liquid crystal panel, the liquid crystal panel including a plurality of pixel units, wherein, each of the pixel units comprises sub pixel units of a plurality of colors, wherein, each of partial sub pixel units among sub pixel units of a part or all of the plurality of colors among all sub pixel units included in the liquid crystal panel includes a main pixel area and a secondary pixel area, the driving method comprises:

acquiring a grayscale value of a picture to be displayed of each of the partial sub pixel units;

searching for a main grayscale value and a secondary grayscale value corresponding to the grayscale value of the picture to be displayed of the each of the partial sub pixel units from a corresponding relationship between grayscale values of a color of each of the partial sub pixel units and the main grayscale values and the secondary grayscale values; and

providing the searched main grayscale value and the secondary grayscale value to areas of the main pixel unit and the secondary pixel unit of the each of the partial sub pixel units respectively.

2. The driving method of claim **1**, wherein each of all sub pixel units in partial pixel units includes the main pixel area and the secondary pixel area, and all the sub pixel units in the other partial pixel units do not include the main pixel area and the secondary pixel area.

3. The driving method of claim **2**, wherein the sub pixel units in the partial pixel units are not adjacent.

4. The driving method of claim **1**, wherein the corresponding relationship between the grayscale values of each of the colors and the main grayscale values and the secondary grayscale values satisfies the following conditions: in an order of magnitudes of the grayscale values of any one color, respectively providing the main grayscale values and the secondary grayscale values corresponding to the grayscale values to the main pixel areas and the secondary pixel areas of the sub pixel units of the any one color among the partial sub pixel units in sequence, and a relation curve graph between the grayscale values and luminances of the sub pixel units of the any one color at the slant angle β is same as or similar to a predetermined gamma (γ) curve.

5. The driving method of claim **4**, wherein the corresponding relationship between the grayscale values of the any one color and the main grayscale values and secondary grayscale values are acquired from the following steps:

S101, acquiring an actual luminance value Lvα of each grayscale G of a sub pixel unit of the any one color of the liquid crystal panel at a front view angle α;

S102, acquiring an actual luminance value Lvβ of each grayscale G of the sub pixel unit of the any one color of the liquid crystal panel at a slant view angle β;

S103, according to an area ratio of a:b of the main pixel area and the secondary pixel area of the sub pixel unit of the any one color, dividing the actual luminance value Lvα into actual values LvMα and LvSβ of each grayscale G of the main pixel area and the secondary pixel area at the front view angle α, dividing the actual luminance value Lvβ into actual values LvMβ and LvSβ of each grayscale G of the main pixel area and the secondary pixel area at the slant view angle β according to the following equations:

$$LvM\alpha : LvS\alpha = a:b,\ LvM\alpha + LvS\alpha = Lv\alpha;$$

$$LvM\beta : LvS\beta = a:b,\ LvM\beta + LvS\beta = Lv\beta;$$

S104: calculating theoretical luminance values LvGxα and LvGxβ of the gray scale G of the sub pixel unit of the any one color of the liquid crystal panel at the front view angle α and the slant angle β according to the actual luminance values Lvα(max) and Lvβ(max) of a highest grayscale max acquired in steps **S101** and **S102**, in conjunction with a equation of the predetermined gamma (γ) curve and

$$\left(\frac{G}{\max}\right)^{\gamma} = \frac{LvG}{Lv(\mathrm{Max})};$$

S105, determining the main grayscale value and the secondary value corresponding to each of grayscale values of the any one color, wherein, as for any one grayscale value Gx, following equations are calculated according to the actual luminance values LvMα, LvMβ, LvSα and LvSβ obtained in the result of the above step **S103** and the theoretical luminance values LvGxα and LvGxβ obtained in the result of the above step **S104**:

$$\Delta 1 = LvM\alpha + LvS\alpha - LvGx\alpha;\ \Delta 2 = LvM\beta + LvS\beta - LvGx\beta;$$

$$y = \Delta 1^2 + \Delta 2^2;$$

when y is minimal, corresponding grayscale values Gmx and Gsx are set to be the main grayscale value and the secondary grayscale value corresponding to the any one grayscale value Gx.

6. The driving method of claim **5**, wherein the step **S101** comprises:

measuring the gamma (γ) curve of the sub pixel unit of the any one color at the front view angle α directly; and

determining the actual luminance value Lvα according to the gamma (γ) curve.

7. The driving method of claim **5**, wherein the step **S102** comprises:

measuring the gamma (γ) curve of the sub pixel unit of the any one color at the slant view angle β directly; and

determining the actual luminance value Lvβ according to the gamma (γ) curve.

8. The driving method of claim **5**, wherein the front view angle α is 0°, and the squint angle β is 30°-80°.

9. A liquid crystal panel, comprising a gate controller, a source controller and a plurality of pixel units, each of the pixel units comprising sub pixel units of a plurality of colors, wherein, each of partial sub pixel units among sub pixel units of a part or all of the plurality of colors among all sub pixel units included in the liquid crystal panel includes a main pixel area and a secondary pixel area; as for any one sub pixel unit in the partial sub pixel units, the gate controller provides scanning signals to the main pixel area and the secondary pixel area of the any one sub pixel unit through the same scanning line, and the source controller provides data signals to the main pixel area and the secondary pixel area of the any one sub pixel unit through different data lines;

wherein a driving method of the liquid crystal panel comprises:

acquiring a grayscale value of a picture to be displayed of each of the partial sub pixel units;

searching for a main grayscale value and a secondary grayscale value corresponding to the grayscale value of the picture to be displayed of the each of the partial sub pixel units from a corresponding relationship between grayscale values of a color of each of the partial sub pixel units and the main grayscale values and the secondary grayscale values; and

providing the searched main grayscale value and the secondary grayscale value to areas of the main pixel unit and the secondary pixel unit of the each of the partial sub pixel units respectively.

10. The liquid crystal panel of claim **9**, wherein each of all sub pixel units in partial pixel units includes the main pixel area and the secondary pixel area, and all the sub pixel units in the other partial pixel units do not include the main pixel area and the secondary pixel area.

11. The liquid crystal panel of claim **10**, wherein the sub pixel units in the partial pixel units are not adjacent.

12. The liquid crystal panel of claim **9**, wherein the corresponding relationship between the grayscale values of each of the colors and the main grayscale values and the secondary grayscale values satisfies the following conditions: in an order of magnitudes of the grayscale values of any one color, respectively providing the main grayscale values and the secondary grayscale values corresponding to the grayscale values to the main pixel areas and the secondary pixel areas of the sub pixel units of the any one color among the partial sub pixel units in sequence, and a relation curve graph between the grayscale values and luminances of the sub pixel units of the any one color at the slant angle β is same as or similar to a predetermined gamma (γ) curve.

13. The liquid crystal panel of claim **12**, wherein the corresponding relationship between the grayscale values of the any one color and the main grayscale values and secondary grayscale values are acquired from the following steps:

S**101**, acquiring an actual luminance value Lvα of each grayscale G of a sub pixel unit of the any one color of the liquid crystal panel at a front view angle α;

S**102**, acquiring an actual luminance value Lvβ of each grayscale G of the sub pixel unit of the any one color of the liquid crystal panel at a slant view angle β;

S**103**, according to an area ratio of a:b of the main pixel area and the secondary pixel area of the sub pixel unit of the any one color, dividing the actual luminance value Lvα into actual values LvMα and LvSβ of each grayscale G of the main pixel area and the secondary pixel area at the front view angle α, dividing the actual luminance value Lvβ into actual values LvMβ and LvSβ of each grayscale G of the main pixel area and the secondary pixel area at the slant view angle β according to the following equations:

$$LvM\alpha : LvS\alpha = a:b,\ LvM\alpha + LvS\alpha = Lv\alpha;$$

$$LvM\beta : LvS\beta = a:b,\ LvM\beta + LvS\beta = Lv\beta;$$

S**104**: calculating theoretical luminance values LvGxα and LvGxβ of the gray scale G of the sub pixel unit of the any one color of the liquid crystal panel at the front view angle α and the slant angle β according to the actual luminance values Lvα(max) and Lvβ(max) of a highest grayscale max acquired in steps S**101** and S**102**, in conjunction with a equation of the predetermined gamma (γ) curve and

$$\left(\frac{G}{\max}\right)^{\gamma} = \frac{LvG}{Lv(\mathrm{Max})};$$

S**105**, determining the main grayscale value and the secondary value corresponding to each of grayscale values of the any one color, wherein, as for any one grayscale value Gx, following equations are calculated according to the actual luminance values LvMα, LvMβ, LvSα and LvSβ obtained in the result of the above step S**103** and the theoretical luminance values LvGxα and LvGxβ obtained in the result of the above step S**104**:

$$\Delta 1 = LvM\alpha + LvS\alpha - LvGx\alpha;\ \Delta 2 = LvM\beta + LvS\beta - LvGx\beta;$$
$$y = \Delta 1^2 + \Delta 2^2;\ \text{and}$$

when y is minimal, corresponding grayscale values Gmx and Gsx are set to be the main grayscale value and the secondary grayscale value corresponding to the any one grayscale value Gx.

14. The liquid crystal panel of claim **13**, wherein the step S**101** comprises:

measuring the gamma (γ) curve of the sub pixel unit of the any one color at the front view angle α directly; and

determining the actual luminance value Lvα according to the gamma (γ) curve.

15. The liquid crystal panel of claim **13**, wherein the step S**102** comprises:

measuring the gamma (γ) curve of the sub pixel unit of the any one color at the slant view angle β directly; and

determining the actual luminance value Lvβ according to the gamma (γ) curve.

16. The liquid crystal panel of claim **13**, wherein the front view angle α is 0°, and the squint angle β is 30°-80°.

* * * * *

专利名称(译)	液晶面板及其驱动方法		
公开(公告)号	US20170148396A1	公开(公告)日	2017-05-25
申请号	US14/781133	申请日	2015-08-12
[标]申请(专利权)人(译)	深圳市华星光电技术有限公司		
申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
当前申请(专利权)人(译)	深圳市中国星光电科技有限公司.		
[标]发明人	CHEN LIXUAN KANG CHIH TSUNG		
发明人	CHEN, LIXUAN KANG, CHIH-TSUNG		
IPC分类号	G09G3/36 G09G3/20		
CPC分类号	G09G3/3607 G09G3/2003 G09G2300/0443 G09G2320/0633 G09G2300/0452 G09G2320/0673 G09G2320/0242 G09G3/3611 G09G2320/028 G09G2320/068		
优先权	201510326020.2 2015-06-12 CN		
其他公开文献	US9990892		
外部链接	Espacenet USPTO		

摘要(译)

一种液晶面板，包括多个像素单元，每个像素单元包括多种颜色的子像素单元，包括在液晶面板中的子像素单元包括主像素区域和次像素区域。该驱动方法包括：获取每个部分子像素单元的待显示图片的灰度值;从每个部分子像素的颜色的灰度值之间的对应关系中搜索与要显示的每个部分子像素单元的图片的灰度值对应的主灰度值和次灰度值单位和主要灰度值和次要灰度值;将搜索到的主灰度值和次灰度值分别提供给每个部分子像素单元的主像素单元和次像素单元的区域。