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(54) **Driving method and apparatus of liquid crystal display apparatus, and liquid crystal display apparatus**

Antriebsverfahren und -vorrichtung einer Flüssigkristallanzeigevorrichtung und Flüssigkristallanzeigevorrichtung

Procédé et appareil de commande d'appareil d'affichage à cristaux liquides et appareil d'affichage à cristaux liquides

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Description

TECHNICAL FIELD

[0001] The present invention relates to a field of liquid crystal display, and particularly to a driving method and apparatus of a liquid crystal display apparatus and the liquid crystal display apparatus, capable of improving display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc.

BACKGROUND

[0002] A Thin Film Transistor Liquid Crystal Display (TFT-LCD) is a display manner used widely currently. Fig.1 is a block diagram illustrating a driving circuit of an existing thin film transistor liquid crystal display, and as illustrated in Fig.1, the driving circuit comprises: a timing controller (TCON), a source driver, a gate driver and a gray scale voltage generator. The timing controller sends gray scale data signals RGB, a polarity inversion signal POL, a latch signal TP to the source driver, sends a frame start signal STV, a clock signal CPV and an output enable signal OE to the gate driver. The gate driver and the source driver output row signals and column signals, respectively, so as to control a liquid crystal display panel (LCD panel) to display.

[0003] The liquid crystal display is of a voltage driving type, that is, a transmittance of a liquid crystal box is controlled by applying different voltages at two terminals of the liquid crystal box, so as to implement the display. Each of pixels is generally divided into R sub-pixel, G sub-pixel and B sub-pixel, wherein one terminal of each of the sub-pixels is a common potential to which a same voltage referred to as a common voltage Vcom is applied, and the other terminal of each of the sub-pixels is a pixel voltage supplied by the source driver. If the voltages applied to the liquid crystal box remain a same polarity, the liquid crystal would be polarized and fail to operate, therefore the liquid crystal driving is implemented by polarity inversion schemes. If a pixel voltage is smaller than the common voltage Vcom, it is referred to as a negative polarity driving; if the pixel voltage is greater than the common voltage Vcom, it is referred to as a positive polarity driving. Manners of the polarity inversion are varied, such as a frame inversion, a row inversion, a column inversion, a point inversion, etc. As illustrated in Fig.2, which is a schematic diagram of an existing point inversion driving manner, the driving polarities of adjacent sub-pixels are opposite. In particular, in the Nth frame, the polarity of the sub-pixel at the first column of the first row is + (positive polarity driving), the polarity of the sub-pixel at the second column of the first row is - (negative polarity driving), the polarity of the sub-pixel at the third column of the first row is + (positive polarity driving), and so on; the polarity of the sub-pixel at the first column of the second row is -, the polarity of the sub-pixel at the second column of the second row is +, the polarity of the

sub-pixel at the third column of the second row is -, and so on; and at the next frame (the (N+1)th frame), the polarities of the all sub-pixels in the (N+1)th frame are opposite to those of the corresponding sub-pixels in the Nth frame. Such driving manner is optimal for a picture quality because the polarity in the entire picture reaches a balance.

[0004] However a case of polarity unbalance may still occur in same special pictures and cause a phenomenon of green attachment. For example, when a window picture is displayed, colors at two sides of the window may differ from colors at other positions, that is, a so-called lateral crosstalk occurs. Generation reasons for such phenomenon are as follows: the liquid crystal display adopts a row scan manner, when gates of one row are turned on, the pixel voltages of all sub-pixels are written to the respective sub-pixels through respective data electrodes, but a coupling capacitor exists between each of the data electrodes and the Vcom electrode, such that a capacitor coupling effect would occur and pull up or down the Vcom voltage if the pixel voltages of the one row are unbalanced, which may cause errors in voltages written actually. As illustrated in Fig.3, the point inversion driving manner is adopted, but amplitudes of the gray scale voltages at the two adjacent pixels are different, such that the pixel voltages on the first row are negative entirely and pull down the Vcom voltage, while the pixel voltages on the second row are positive entirely and pull up the Vcom voltage. Since the Vcom is a reference common voltage, its deviation may lead to errors in the actual voltage across the pixel.

[0005] US 2012/062610 A1, which is considered the closest prior art, discloses a dynamic polarity control method for driving an LCD. Gray level information is obtained, which indicates gray levels of dots in an image to be displayed. The gray level information is applied to each of a plurality of polarity patterns to obtain a plurality of combined patterns, wherein each of the polarity patterns has an individual polarity distribution. The gray levels of each of the combined patterns are summed up. A final pattern is selected from the plurality of polarity patterns according to the summed results, to drive the LCD for displaying the image.

SUMMARY

[0006] A technical problem to be solved by the present invention is to provide a driving method and a driving apparatus of a liquid crystal display apparatus, and the liquid crystal display apparatus in order to improve display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc.

[0007] The problem is solved by the features of the respective independent claims. Further embodiments are defined in the respective dependent claims.

[0008] As compared with the prior art, the driving method of the liquid crystal display apparatus according to the embodiments of the present disclosure may generate

gray scale data of sub-pixels according to the received image data, generate gray scale voltage polarity signals respectively corresponding to the gray scale data of the plurality of sub-pixels, and output the gray scale data and the corresponding polarity signal of the each sub-pixel to the source driver of the liquid crystal display apparatus. Because the gray scale voltage polarity signals may make the gray scale voltages of the plurality of sub-pixels tend to zero entirely, a pulling influence on the common voltage Vcom can be avoided, so that it improves display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc, and in turn enhances a display effect.

[0009] In the driving apparatus of the liquid crystal display apparatus according to the embodiments of the present disclosure, the polarity analyzer is newly added, and the polarity analyzer may analyze the gray scale data of the plurality of sub-pixels and generate the gray scale voltage polarity signals, which are used for making gray scale voltages of the plurality of sub-pixels tend to zero entirely, respectively corresponding to the gray scale data of the plurality of sub-pixels, therefore a pulling influence on the common voltage Vcom can be avoided, so that it improves display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc, and in turn enhances a display effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig.1 is a block diagram illustrating a driving circuit of an existing thin film transistor liquid crystal display; Fig.2 is a schematic diagram illustrating an existing point inversion driving manner; Fig.3 is a schematic diagram illustrating a case wherein a common voltage generated by the existing point inversion driving manner is pulled; Fig.4 is a block diagram illustrating a structure of a liquid crystal display apparatus according to the embodiments of the present disclosure; Fig.5 is a block diagram illustrating a structure of a timing controller according to the embodiments of the present disclosure; Fig.6 is a schematic diagram illustrating gray scale data of a frame of picture before being processed by a polarity analyzer according to the embodiments of the present disclosure; Fig.7 is a schematic diagram illustrating a corresponding relationship between the gray scale data and gray scale voltage amplitudes according to the embodiments of the present disclosure; Fig.8 is a schematic diagram illustrating data after being processed by the polarity analyzer according to the embodiments of the present disclosure; Fig.9 is a diagram illustrating an effect after the polarity analyzer processes according to the embodiments of the present disclosure; and

Fig.10 is a flowchart illustrating a driving method of the liquid crystal display apparatus according to the embodiments of the present disclosure.

5 DETAILED DESCRIPTION

[0011] Objects, solutions and advantages of the present disclosure will be more apparent from the following detailed description taken in conjunction with the accompanying drawings.

[0012] During the liquid crystal display driving, if the polarities of the gray scale voltages of the sub-pixels in each row is unbalance, it may pull the common voltage Vcom up or down and lead to the display defects such as a green attachment, a crosstalk, a flicker, etc. The embodiments of the present disclosure take a plurality of sub-pixels as a processing unit, generate the gray scale voltage polarity signals, which may be used for making gray scale voltages of the plurality of sub-pixels tend to zero entirely, respectively corresponding to the gray scale data of the plurality of sub-pixels, therefore a pulling influence on the common voltage Vcom can be avoided and the display defects may be improved.

[0013] The present disclosure provides a driving method of a liquid crystal display apparatus, for improving the display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc.

[0014] As illustrated in Fig.10, which is a flowchart illustrating a driving method of the liquid crystal display apparatus according to the embodiments of the present disclosure, the driving method may comprises steps as follows.

[0015] In Step 101, gray scale data of sub-pixels is generated according to received image data.

[0016] Image data input externally is acquired and processed, and the gray scale data (RGB data) of the sub-pixels may be generated.

[0017] In Step 102, a plurality of sub-pixels are taken as a processing unit, gray scale voltage polarity signals, which are used for making gray scale voltages of the plurality of sub-pixels tend to zero entirely, are generated respectively corresponding to the gray scale data of the plurality of sub-pixels.

[0018] In particular, the gray scale voltage polarity signal corresponding to the gray scale data of a first sub-pixel of the plurality of sub-pixels may be set as an initial value, and then the gray scale voltage polarity signal corresponding to the gray scale data of a nth sub-pixel of the plurality of sub-pixels may be set as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages corresponding to the gray scale data of the previous n-1 sub-pixels, wherein $2 \leq n \leq M$, $M > 2$, and M is the total number of sub-pixels included in the plurality of sub-pixels, so that the gray scale voltages of the plurality of sub-pixels tend to zero entirely.

[0019] The plurality of sub-pixels may be several sub-pixels in one row, and also may be half a row of sub-

pixels, two or more rows of sub-pixels or sub-pixels in a predetermined area. For example, when a half-row driving is adopted, the half row of sub-pixels may be set as a processing unit; and when an area driving is adopted, the sub-pixels in the predetermined area may be set as a processing unit.

[0020] In an example, in the Step 102, a row of sub-pixels are taken as a processing unit, gray scale voltage polarity signals, which are used for making gray scale voltages of the corresponding row tend to zero entirely, are generated respectively corresponding to the gray scale data of sub-pixels in the row.

[0021] In the Step 102, the gray scale voltage polarity signals of sub-pixels may be generated specially by means of analysis by a polarity analyzer according to a driving characteristic of the liquid crystal display apparatus.

[0022] Fig.6 illustrates gray scale data (RGB data) of a frame of picture. The driving characteristic of the liquid crystal display apparatus decides a corresponding relationship between gray scale data and a voltage applied across a sub-pixel actually, therefore data in the corresponding relationship table, that is a lookup table, of the gray scale data and the gray scale voltage amplitudes is decided by the driving characteristic of the liquid crystal display apparatus. The corresponding relationship between the gray scale data and the gray scale voltage amplitudes may be implemented by a gray scale voltage generator.

[0023] Fig.7 illustrates a schematic diagram of the corresponding relationship table, i.e. the lookup table, of the gray scale data and the gray scale voltage amplitudes of the liquid crystal display in a normal-white mode, that is, the voltage of the gray scale 0 is highest, the voltage of the gray scale 255 is lowest, and it displays a white picture when no voltage is applied.

[0024] Fig.7 illustrates a 3-order lookup table, wherein the voltages of the gray scales 0, 32, 64, 96, 127, 160, 192, 224 and 255 may be obtained by looking up the table directly. Other voltages, such as the voltage of the gray scale 20 may be obtained by an interpolation between the voltages of two gray scales 0 and 32. The lookup table may be enhanced to a 4-order, a 5-order, or even a 8-order in order to increase an algorithm precision.

[0025] A detailed method for generating the polarity signals may comprise: setting the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a first column in each row as an initial value; and setting the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a nth column in each row as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages (including the amplitudes of the gray scale voltage and the polarities of the gray scale voltage) corresponding to the gray scale data of sub-pixels at previous n-1 columns in the row, wherein $2 \leq n \leq N$, $N > 2$, and N is the total number of sub-pixels in one row.

[0026] In the one frame of picture illustrated in Fig.6, the gray scale data of the sub-pixel at the first column of the first row is 127, and a corresponding gray scale voltage amplitude is obtained by looking up the lookup table illustrated in Fig.7, namely, 1.8, the polarity signal is initially set as +, that is, the gray scale voltage is +1.8; the gray scale data of the sub-pixel at the second column of the first row is 0, a corresponding voltage amplitude is obtained by looking up the lookup table illustrated in Fig.7, namely, 4.0, and because the polarity of the gray scale voltage of the sub-pixel at the first column of the first row is positive, the voltage polarity signal for the second column of the first row is set as negative, that is, the gray scale voltage of is -4.0, thus the sum of the gray scale voltages of the previous two columns in the first row is $1.8 + (-4.0) = -2.6$ and shows the negative polarity; the gray scale voltage polarity signal of the sub-pixel at the third column of the first row is set as +; and the polarities of the data at subsequent respective columns in this row are determined according to the previous data: the polarity signal of the sub-pixel is positive if the polarity obtained by summing the gray scale voltages of sub-pixels in the row before this column shows the negative polarity, and the polarity signal of the sub-pixel is negative if the polarity obtained by summing the gray scale voltages of sub-pixels in the row before this column shows the positive polarity.

[0027] Optionally, the initial values of the polarities corresponding to the sub-pixels at the first columns in two adjacent rows in one frame of picture within the image data are opposite with each other. The initial value of the gray scale voltage polarity signal corresponding to the gray scale data at the first column of the second row is opposite to that of the gray scale voltage at the first column of the first row, namely, -. The polarities of the data at subsequent respective columns are obtained in the same manner and the polarities of the gray scale voltages in other respective rows are set in the same manner, so that the polarities of the gray scale voltages in two adjacent rows are as opposite as possible.

[0028] Optionally, the initial values of the polarities corresponding to sub-pixels at the first columns of the first rows within two adjacent frames of picture of the image data are opposite. For a next frame of the picture, the polarity of the gray scale voltage of the sub-pixel at the first column of the first row may be set as negative, which is opposite to that in the previous frame, so that the polarities of the gray scale voltages within two adjacent frames are opposite for a same sub-pixel.

[0029] In Step 103, the gray scale data and the corresponding polarity signal of the each sub-pixel is output to a source driver of the liquid crystal display apparatus.

[0030] The source driver may output a corresponding pixel voltage to the liquid crystal panel and control the liquid crystal panel to display according to the gray scale data and the polarity signal after receiving the gray scale data and the corresponding polarity signal of the each sub-pixel.

[0031] The driving method of the liquid crystal display apparatus according to the embodiments of the present disclosure may generate gray scale data of sub-pixels according to received image data, generate gray scale voltage polarity signals respectively corresponding to the gray scale data of a row of sub-pixels, and output the gray scale data and the corresponding polarity signal of each sub-pixel to a source driver of the liquid crystal display apparatus. Because the gray scale voltage polarity signals may make the gray scale voltages of the corresponding row of sub-pixels tend to zero entirely, a pulling influence on the common voltage Vcom can be avoided, so that it improves display defects caused by turbulence in the common voltage, such as a green attachment, a crosstalk, a flicker, etc, and in turn enhances a display effect.

[0032] The present disclosure provides a driving apparatus of a liquid crystal display apparatus, for improving the display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc.

[0033] Fig.4 is a block diagram illustrating a structure of a liquid crystal display apparatus according to the embodiments of the present disclosure, wherein the liquid crystal display apparatus may comprise a driving apparatus and a liquid crystal panel connected with the driving apparatus.

[0034] In particular, the driving apparatus of the liquid crystal display apparatus according to the embodiments of the present disclosure may comprise a timing controller (TCON), a source driver, a gate driver and a gray scale voltage generator. The timing controller sends gray scale data (RGB), gray scale voltage polarity signals POL corresponding to the gray scale data and a latch signal TP to the source driver, sends a frame start signal STV, a clock signal CPV and an output enable signal OE to the gate driver. The source driver and the gate driver output row signals and column signals, respectively, so as to control the liquid crystal display panel (the LCD panel) to display.

[0035] As seen from Fig.4, no fixed polarity conversion signal POL is set in the embodiment of the present disclosure, and the gray scale voltage polarity signal of each sub-pixel is generated by a polarity analyzer in the timing controller. Further, the embodiment of the present disclosure is not limited to the case where the polarity analyzer must be included in the timing controller.

[0036] The polarity analyzer takes a plurality of sub-pixels as a processing unit, and generates the gray scale voltage polarity signals, which are used for making gray scale voltages of the plurality of sub-pixels tend to zero entirely, respectively corresponding to the gray scale data of the plurality of sub-pixels.

[0037] In particular, the polarity analyzer may comprise: a first setting unit for setting the gray scale voltage polarity signal corresponding to the gray scale data of a first sub-pixel of the plurality of sub-pixels as an initial value; and a second setting unit for setting the gray scale

voltage polarity signal corresponding to the gray scale data of a nth sub-pixel of the plurality of sub-pixels as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages corresponding to the gray scale data of the previous n-1 sub-pixels, wherein $2 \leq n \leq M$, $M > 2$, and M is the total number of sub-pixels included in the plurality of sub-pixels.

[0038] The plurality of sub-pixels may be several sub-pixels in one row, and also may be half a row of sub-pixels, two or more rows of sub-pixels or sub-pixels in a predetermined area. For example, when a half-row driving is adopted, the half row of sub-pixels may be set as a processing unit; and when an area driving is adopted, the sub-pixels in the predetermined area may be set as a processing unit.

[0039] Preferably, the polarity analyzer calculates the gray scale voltage polarity signals respectively corresponding to the gray scale data of sub-pixels in each of rows by calculating the gray scale data of the sub-pixels in the row, inputs the polarity signals into the source driver along with the gray scale data, and the source driver generates data voltages to drive the LCD panel. Because the polarity signal of each sub-pixel is calculated and generated by the polarity analyzer, it may control the gray scale voltages in each row to tend to zero entirely and avoid the pulling influence on the common voltage Vcom.

[0040] Fig.5 is a block diagram illustrating a structure of a timing controller according to the embodiments of the present disclosure, wherein the timing controller may comprise a data receiver, a data processor, the polarity analyzer, a lookup table, a data transmitter and a control signal generator. The data receiver receives the image data input externally, the data processor processes the input image data and generates the gray scale data (RGB data) of the sub-pixels; after the polarity analyzer analyzes the gray scale data of one row, it generates the gray scale voltage polarity signals POL respectively corresponding to the gray scale data; the lookup table provides the polarity analyzer with a basis used for analysis; the gray scale data and the gray scale voltage polarity signals POL generated by the polarity analyzer are input to the data transmitter; the data transmitter sends the gray scale data and the corresponding gray scale voltage polarity signals POL to the source driver; the control signal generator generates the latch signal TP, the frame start signal STV, the clock signal CPV and the output enable signal OE, and outputs them to the source driver or the gate driver, respectively.

[0041] In the embodiments of the present disclosure, the polarity analyzer generates the gray scale voltage polarity signals respectively corresponding to the gray scale data of the sub-pixels by analyzing the gray scale data of the sub-pixels according to a driving characteristic of the liquid crystal display apparatus. The polarity analyzer takes a row of sub-pixels as a processing unit, and generates the gray scale voltage polarity signals, which are used for making gray scale voltages of the corresponding row tend to zero entirely, respectively corre-

sponding to the gray scale data of sub-pixels in the row. The polarity analyzer further comprises: a third setting unit for setting the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a first column in each row as an initial value; and a fourth setting unit for setting the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a nth column in each row as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages corresponding to the gray scale data of sub-pixels at previous n-1 columns in the row, wherein $2 < n < N$, $N > 2$, and N is the total number of sub-pixels in one row.

[0042] Optionally, the initial values of the polarities corresponding to sub-pixels at the first columns in two adjacent rows within one frame of picture of the image data are opposite; the initial values of the polarities corresponding to sub-pixels at the first columns of the first rows within two adjacent frames of picture of the image data are opposite.

[0043] An operation method of the polarity analyzer will be illustrated thereafter.

[0044] Fig.6 illustrates the gray scale data (RGB data) of one frame of picture generated by the data processor. There is a corresponding relationship between the gray scale data and a voltage applied across the sub-pixel actually, and the corresponding relationship between the gray scale data and the gray scale voltage amplitudes is implemented by the gray scale voltage generator, as illustrated in Fig.7. The corresponding relationship between the gray scale data and the gray scale voltage amplitudes is for a normal-white mode liquid crystal display, that is, the voltage of the gray scale 0 is highest, the voltage of the gray scale 255 is lowest, and it displays a white picture when no voltage is applied. A lookup table may be generated according to the corresponding relationship between the gray scale data and the gray scale voltage amplitudes. Fig.7 illustrates a 3-order lookup table, wherein the voltages of 0, 32, 64, 96, 127, 160, 192, 224 and 255 may be obtained by looking up the table directly. Other voltages, such as the voltage of the gray scale 20 may be obtained by an interpolation between the voltages of two gray scales 0 and 32. The lookup table may be enhanced to a 4-order, a 5-order, or even a 8-order in order to increase an algorithm precision.

[0045] In the one frame of picture illustrated in Fig.6, the gray scale data of the sub-pixel at the first column of the first row is 127, and a corresponding gray scale voltage amplitude is obtained by looking up the lookup table illustrated in Fig.7, namely, 1.8, a polarity signal is initially set as +, that is, the gray scale voltage is +1.8; the gray scale data of the sub-pixel at the second column of the first row is 0, a corresponding voltage amplitude is obtained by looking up the lookup table illustrated in Fig.7, namely, 4.0, and because the polarity of the gray scale voltage of the sub-pixel at the first column of the first row is positive, the voltage polarity signal for the second column of the first row is set as negative, that is, the gray scale voltage of is -4.0, thus the sum of the gray scale

voltages of the previous two columns in the first row is $1.8 + (-4.0) = -2.6$ and shows the negative polarity; the polarity signal of the gray scale voltage of the sub-pixel at the third column of the first row is set as +; and the polarities of the data at subsequent respective columns in this row are determined according to the previous data: the polarity signal of the sub-pixel is positive if the polarity obtained by summing the gray scale voltages of sub-pixels in the row before this column shows the negative polarity, and the polarity signal of the sub-pixel is negative if the polarity obtained by summing the gray scale voltages of sub-pixels in the row before this column shows the positive polarity.

[0046] The initial value of the polarity signal of the gray scale voltage corresponding to the gray scale data at the first column of the second row is opposite to that of the gray scale voltage at the first column of the first row, namely, -. The polarities of the data at subsequent respective columns are obtained in the same manner and the polarities of the gray scale voltages in other respective rows are set in the same manner, so that the polarities of the gray scale voltages in two adjacent rows are as opposite as possible. For a next frame of the picture, the polarity of the gray scale voltage of the sub-pixel at the first column of the first row may be set as negative, which is opposite to that in the previous frame, so that the polarities of the gray scale voltage within two adjacent frames are opposite for a same sub-pixel.

[0047] According to the above-described algorithm, a data table finally obtained by analysis by means of the polarity analyzer is as illustrated in Fig.8, and its implementation effect is illustrated in Fig.9 wherein the polarity of each row tends to zero. For the data in a same frame of the picture, the pulling effect on the Vcom by the conventional point inversion manner is as shown in Fig.3. A resolution of the general liquid crystal display panel is very high, and each row may comprise 3,000 sub-pixels generally, even up to 6,000 sub-pixels. With the above-described polarity balance algorithm provided in the embodiments of the present disclosure, the gray scale voltages in each row may tend to zero entirely, thus it can improve display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc, and in turn enhance a display effect.

[0048] In the driving apparatus of the liquid crystal display apparatus according to the embodiments of the present disclosure, the polarity analyzer is newly added, and the polarity analyzer may analyze the gray scale data of a row of sub-pixels and generate the gray scale voltage polarity signals, which are used for making gray scale voltages of the row of sub-pixels tend to zero entirely, respectively corresponding to the gray scale data of the row of sub-pixels, therefore a pulling influence on the common voltage Vcom can be avoided, so that it improves display defects caused by turbulence in a common voltage, such as a green attachment, a crosstalk, a flicker, etc, and in turn enhances a display effect.

[0049] At last, please note that the embodiments of the

present disclosure being thus described are only for purpose of illustration rather than limitation, and modifications and equivalent alternatives may be made to the embodiments of the present disclosure without departing from the scope of the present disclosure as defined in the flowing claims.

Claims

1. A driving method of a liquid crystal display apparatus, comprising:

(101) generating gray scale data of sub-pixels according to received image data;
 (102) taking a plurality of sub-pixels as a processing unit and setting a gray scale voltage polarity signal corresponding to the gray scale data of a first sub-pixel of the plurality of sub-pixels as an initial value; and
 (103) outputting the gray scale data and the corresponding polarity signal of each sub-pixel to a source driver of the liquid crystal display apparatus;

characterized by, in step (102), further setting a gray scale voltage polarity signal corresponding to the gray scale data of each n-th sub-pixel of the plurality of sub-pixels as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages corresponding to the gray scale data of previous n-1 sub-pixels, wherein $2 \leq n \leq M$, $M > 2$, and M is the total number of sub-pixels included in the plurality of sub-pixels.

2. The driving method according to claim 1, wherein the plurality of sub-pixels are half a row of sub-pixels, a plurality of rows of sub-pixels or sub-pixels in a predetermined area.
3. The driving method according to claim 1, wherein the plurality of sub-pixels is one row of the sub-pixels, and the method comprises:

setting the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a first column in the row as an initial value; and setting the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a n-th column in the row as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages corresponding to the gray scale data of sub-pixels at previous n-1 columns in the row, wherein $2 < n < N$, $N > 2$, and N is the total number of sub-pixels in one row.

4. The driving method according to claim 3, wherein the initial values of the polarities corresponding to

sub-pixels at the first columns in two adjacent rows within a frame of picture of the image data are opposite.

5. The driving method according to claim 3 or 4, wherein the initial values of the polarities corresponding to sub-pixels at the first columns of the first rows within two adjacent frames of picture of the image data are opposite.

6. A driving apparatus of a liquid crystal display apparatus, comprising a timing controller, a gate driver and a source driver, and a polarity analyzer; wherein the polarity analyzer is configured to take a plurality of sub-pixels as a processing unit and comprises a first setting unit being configured to set the gray scale voltage polarity signal corresponding to the gray scale data of a first sub-pixel of the plurality of sub-pixels as an initial value; wherein the timing controller is configured to generate the gray scale data of the sub-pixels according to a received image data, and output the gray scale data of the each sub-pixel and the corresponding gray scale voltage polarity signal obtained by the polarity analyzer to the source driver,

characterized in that the polarity analyzer further comprises a second setting unit configured to set the gray scale voltage polarity signal corresponding to the gray scale data of each n-th sub-pixel of the plurality of sub-pixels as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages corresponding to the gray scale data of previous n-1 sub-pixels, wherein $2 \leq n \leq M$, $M > 2$, and M is the total number of sub-pixels included in the plurality of sub-pixels.

7. The driving apparatus according to claim 6, wherein the plurality of sub-pixels are half a row of sub-pixels, a plurality of rows of sub-pixels or sub-pixels in a predetermined area.
8. The driving apparatus according to claim 6, wherein the plurality of sub-pixels is one row of the sub-pixels, and the polarity analyzer comprises:

a third setting unit is configured to set the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a first column in each row as an initial value; and a fourth setting unit is configured to set the gray scale voltage polarity signal corresponding to the gray scale data of a sub-pixel at a n-th column in each row as a polarity signal opposite to a polarity signal obtained by summing the gray scale voltages corresponding to the gray scale data of sub-pixels at previous n-1 columns in the row, wherein $2 < n < N$, $N > 2$, and N is the total number of sub-pixels in one row.

9. The driving apparatus according to claim 8, wherein: the initial values of the polarities corresponding to sub-pixels at the first columns in two adjacent rows within a frame of picture of the image data are opposite. 5
10. The driving apparatus according to claim 8 or 9, wherein: the initial values of the polarities corresponding to sub-pixels at the first columns of the first rows within two adjacent frames of picture of the image data are opposite. 10
11. A liquid crystal display apparatus comprising the driving apparatus of any one of claims 6-10 and a liquid crystal panel connected with the driving apparatus. 15

Patentansprüche 20

1. Ansteuerungsverfahren einer Flüssigkristall-Anzeigevorrichtung mit:
- (101) Erzeugen von Graustufendaten von Sub-Pixeln gemäß empfangener Bilddaten; 25
- (102) Nehmen einer Vielzahl von Sub-Pixeln als eine Verarbeitungseinheit und Einstellen eines Graustufenspannung-Polaritätssignals entsprechend den Graustufendaten eines ersten Sub-Pixel der Vielzahl von Sub-Pixeln als einen Anfangswert; und 30
- (103) Ausgeben der Graustufendaten und des zugehörigen Polaritätssignals jedes Sub-Pixels an eine Source-Ansteuerung der Flüssigkristall-Anzeigevorrichtung; 35
- gekennzeichnet durch**, im Schritt (102) weiter Einstellen eines Graustufenspannung-Polaritätssignals entsprechend den Graustufendaten jedes n-ten Sub-Pixels der Vielzahl von Sub-Pixeln als ein Polaritätssignal entgegengesetzt einem Polaritätssignal, das durch Summieren der Graustufenspannungen entsprechend den Graustufendaten von vorausgehenden n-1 Unterpixeln erhalten wurde, wobei $2 \leq n \leq M$, $M > 2$, und M die Gesamtzahl der Sub-Pixel einschließlich der Vielzahl von Sub-Pixeln ist. 40
2. Ansteuerungsverfahren gemäß Anspruch 1, wobei die Vielzahl von Sub-Pixeln die Hälfte von einer Zeile von Sub-Pixeln, eine Vielzahl von Zeilen von Sub-Pixeln oder von Sub-Pixeln in einem vorbestimmten Bereich ist. 50
3. Ansteuerungsverfahren gemäß Anspruch 1, wobei die Vielzahl von Sub-Pixeln eine Reihe von Sub-Pixel ist, und das Verfahren aufweist: 55

Einstellen des Graustufenspannung-Polaritätssignals entsprechend den Graustufendaten eines Sub-Pixels an einer ersten Spalte in der Zeile als einen Anfangswert; und

Einstellen des Graustufenspannung-Polaritätssignals gemäß den Graustufendaten eines Sub-Pixel bei einer n-ten Spalte in der Zeile als ein Polaritätssignal entgegengesetzt einem Polaritätssignal, das durch Summieren der Graustufenspannungen entsprechend den Graustufendaten der Sub-Pixel an vorausgehenden n-1 Spalten in der Zeile erhalten wurde, wobei $2 \leq n \leq N$, $N > 2$, und N die Gesamtzahl der Sub-Pixel in einer Zeile ist.

4. Ansteuerungsverfahren gemäß Anspruch 3, wobei die Anfangswerte der Polaritäten entsprechend Sub-Pixeln an der ersten Spalte in zwei benachbarten Zeilen innerhalb eines Rahmens eines Bildes von Bilddaten entgegengesetzt sind.
5. Ansteuerungsverfahren gemäß Anspruch 3 oder 4, wobei die Anfangswerte der Polaritäten entsprechend Sub-Pixeln an den ersten Spalten der ersten Zeilen innerhalb zweier benachbarter Rahmen eines Bildes der Bilddaten entgegengesetzt sind.
6. Anzeigevorrichtung einer Flüssigkristallanzeigevorrichtung mit einer Zeitablaufsteuerung, einer Gate-Ansteuerung und einer Source-Ansteuerung und einem Polarität-Analysator; wobei der Polarität-Analysator konfiguriert ist, eine Vielzahl von Sub-Pixeln als eine Verarbeitungseinheit zu nehmen und eine erste Einstelleinheit aufweist, die konfiguriert ist, das Graustufenspannung-Polaritätssignal entsprechend den Graustufendaten eines ersten Sub-Pixel der Vielzahl von Sub-Pixeln als einen Anfangswert einzustellen; wobei die Zeitablaufsteuerung konfiguriert ist, die Graustufendaten der Sub-Pixel entsprechend empfangener Bilddaten zu erzeugen und die Graustufendaten jedes Sub-Pixels und des zugehörigen Graustufenspannung-Polaritätssignals, das seitens des Polaritäts-Analysators erhalten wurde, an die Source-Ansteuerung auszugeben, **dadurch gekennzeichnet, dass** der Polaritäts-Analysator weiter eine zweite Einstelleinheit aufweist, die konfiguriert ist, das Graustufenspannung-Polaritätssignal entsprechend den Graustufendaten von jedem n-ten Sub-Pixel der Vielzahl von Sub-Pixeln als ein Polaritätssignal entgegengesetzt einem Polaritätssignal einzustellen, das durch Summieren der Graustufenspannungen entsprechend den Graustufendaten von vorausgehenden n-1 Sub-Pixeln erhalten wurde, wobei $2 \leq n \leq M$, $M > 2$, und M die gesamte Zahl von Sub-Pixel einschließlich der Vielzahl von Sub-Pixeln ist.

7. Ansteuervorrichtung gemäß Anspruch 6, wobei die Vielzahl von Sub-Pixeln eine Hälfte einer Zeile von Sub-Pixeln, eine Vielzahl von Zeilen von Sub-Pixeln oder von Sub-Pixeln in einem vorbestimmten Bereich ist.

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8. Ansteuervorrichtung gemäß Anspruch 6, wobei die Vielzahl von Sub-Pixeln eine Zeile von Sub-Pixeln ist und der Polaritäts-Analysator aufweist:

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eine dritte Einstelleinheit konfiguriert, das Graustufenspannung-Polaritätssignal entsprechend den Graustufendaten eines Sub-Pixels an einer ersten Spalte in jeder Zeile als einen Anfangswert einzustellen; und

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eine vierte Einstelleinheit konfiguriert, das Graustufenspannung-Polaritätssignal entsprechend den Graustufendaten eines Sub-Pixels an einer n-ten Spalte in jeder Zeile als ein Polaritätssignal entgegengesetzt einem Polaritätssignal einzustellen, das durch Summieren der Graustufenspannungen entsprechend den Graustufendaten von Sub-Pixeln an vorausgehenden n-1 Spalten in der Zeile erhalten wurde, wobei $2 \leq n \leq N$, $N > 2$, und N die Gesamtzahl der Sub-Pixel in einer Zeile ist.

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9. Ansteuervorrichtung gemäß Anspruch 8, wobei: die Anfangswerte der Polaritäten entsprechend den Sub-Pixeln an den ersten Spalten in zwei benachbarten Zeilen innerhalb eines Rahmens eines Bildes der Bilddaten entgegengesetzt sind.

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10. Ansteuervorrichtung gemäß Anspruch 8 oder 9, wobei: die Anfangswerte der Polaritäten entsprechend Sub-Pixeln an der ersten Spalte von zwei Zeilen innerhalb zweier benachbarter Rahmen eines Bildes der Bilddaten entgegengesetzt sind.

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11. Flüssigkristallanzeigevorrichtung mit der Ansteuervorrichtung gemäß einem der Ansprüche 6 bis 10 und einem Flüssigkristall-Panel, das mit der Ansteuervorrichtung verbunden ist.

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Revendications

1. Procédé de pilotage d'un appareil d'affichage à cristaux liquides, comprenant :

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(101) la génération de données d'échelle de gris de sous-pixels conformément à des données d'image reçues ;

(102) la considération d'une pluralité de sous-pixels en tant qu'unité de traitement et la définition d'un signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle

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de gris d'un premier sous-pixel de la pluralité de sous-pixels en tant que valeur initiale ; et (103) l'émission en sortie des données d'échelle de gris et du signal de polarité correspondant de chaque sous-pixel sur un dispositif de pilotage de source de l'appareil d'affichage à cristaux liquides ;

caractérisé par, au niveau de l'étape (102), la définition en outre d'un signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris de chaque n-ième sous-pixel de la pluralité de sous-pixels en tant que signal de polarité qui est opposé à un signal de polarité qui est obtenu en sommant les tensions d'échelle de gris qui correspondent aux données d'échelle de gris de n-1 sous-pixels précédents, dans lequel $2 \leq n \leq M$, $M > 2$, et M est le nombre total de sous-pixels qui sont inclus dans la pluralité de sous-pixels.

2. Procédé de pilotage selon la revendication 1, dans lequel :

les sous-pixels de la pluralité de sous-pixels sont les sous-pixels de la moitié d'une rangée de sous-pixels, les sous-pixels d'une pluralité de rangées de sous-pixels ou des sous-pixels dans une zone prédéterminée.

3. Procédé de pilotage selon la revendication 1, dans lequel les sous-pixels de la pluralité de sous-pixels sont les sous-pixels d'une seule rangée des sous-pixels, et le procédé comprend :

la définition du signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris d'un sous-pixel au niveau d'une première colonne dans la rangée en tant que valeur initiale ; et

la définition du signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris d'un sous-pixel au niveau d'une première colonne dans la rangée en tant que valeur initiale ; et

la définition du signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris d'un sous-pixel au niveau d'une n-ième colonne dans la rangée en tant que signal de polarité qui est opposé à un signal de polarité qui est obtenu en sommant les tensions d'échelle de gris qui correspondent aux données d'échelle de gris de sous-pixels au niveau de n-1 colonnes précédentes dans la rangée, dans lequel $2 \leq n \leq N$, $N > 2$, et N est le nombre total de sous-pixels dans une seule rangée.

4. Procédé de pilotage selon la revendication 3, dans lequel :

les valeurs initiales des polarités qui correspondent

à des sous-pixels au niveau des premières colonnes dans deux rangées adjacentes à l'intérieur d'une trame d'image des données d'image sont opposées.

5. Procédé de pilotage selon la revendication 3 ou 4, dans lequel :
les valeurs initiales des polarités qui correspondent à des sous-pixels au niveau des premières colonnes des premières rangées à l'intérieur de deux trames d'image adjacentes des données d'image sont opposées. 10
6. Appareil de pilotage d'un appareil d'affichage à cristaux liquides, comprenant un contrôleur de temporisation, un dispositif de pilotage de grille et un dispositif de pilotage de source, et un analyseur de polarité ; dans lequel :
l'analyseur de polarité est configuré de manière à ce qu'il considère une pluralité de sous-pixels en tant qu'unité de traitement et il comprend une première unité de définition qui est configurée de manière à ce qu'elle définisse le signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris d'un premier sous-pixel de la pluralité de sous-pixels en tant que valeur initiale ; dans lequel : 25

le contrôleur de temporisation est configuré de manière à ce qu'il génère les données d'échelle de gris des sous-pixels conformément à des données d'image reçues et de manière à ce qu'il émette en sortie les données d'échelle de gris de chaque sous-pixel et le signal de polarité de tension d'échelle de gris correspondant qui est obtenu par l'analyseur de polarité sur le dispositif de pilotage de source ; 30

caractérisé en ce que l'analyseur de polarité comprend en outre une deuxième unité de définition qui est configurée de manière à ce qu'elle définisse le signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris de chaque n-ième sous-pixel de la pluralité de sous-pixels en tant que signal de polarité qui est opposé à un signal de polarité qui est obtenu en sommant les tensions d'échelle de gris qui correspondent aux données d'échelle de gris de n-1 sous-pixels précédents, dans lequel $2 \leq n \leq M$, $M > 2$, et M est le nombre total de sous-pixels qui sont inclus dans la pluralité de sous-pixels. 40 45 50

7. Appareil de pilotage selon la revendication 6, dans lequel :
les sous-pixels de la pluralité de sous-pixels sont les sous-pixels de la moitié d'une rangée de sous-pixels, les sous-pixels d'une pluralité de rangées de sous-pixels ou des sous-pixels dans une zone prédéterminée. 55

8. Appareil de pilotage selon la revendication 6, dans lequel les sous-pixels de la pluralité de sous-pixels sont les sous-pixels d'une seule rangée des sous-pixels, et l'analyseur de polarité comprend :

une troisième unité de définition qui est configurée de manière à ce qu'elle définisse le signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris d'un sous-pixel au niveau d'une première colonne dans chaque rangée en tant que valeur initiale ; et
une quatrième unité de définition qui est configurée de manière à ce qu'elle définisse le signal de polarité de tension d'échelle de gris qui correspond aux données d'échelle de gris d'un sous-pixel au niveau d'une n-ième colonne dans chaque rangée en tant que signal de polarité qui est opposé à un signal de polarité qui est obtenu en sommant les tensions d'échelle de gris qui correspondent aux données d'échelle de gris de sous-pixels au niveau de n-1 colonnes précédentes dans la rangée, dans lequel $2 \leq n \leq N$, $N > 2$, et N est le nombre total de sous-pixels dans une seule rangée.

9. Appareil de pilotage selon la revendication 8, dans lequel :
les valeurs initiales des polarités qui correspondent à des sous-pixels au niveau des premières colonnes dans deux rangées adjacentes à l'intérieur d'une trame d'image des données d'image sont opposées.
10. Appareil de pilotage selon la revendication 8 ou 9, dans lequel :
les valeurs initiales des polarités qui correspondent à des sous-pixels au niveau des premières colonnes des premières rangées à l'intérieur de deux trames d'image adjacentes des données d'image sont opposées.
11. Appareil d'affichage à cristaux liquides comprenant l'appareil de pilotage selon l'une quelconque des revendications 6 à 10 et un panneau à cristaux liquides qui est connecté à l'appareil de pilotage.

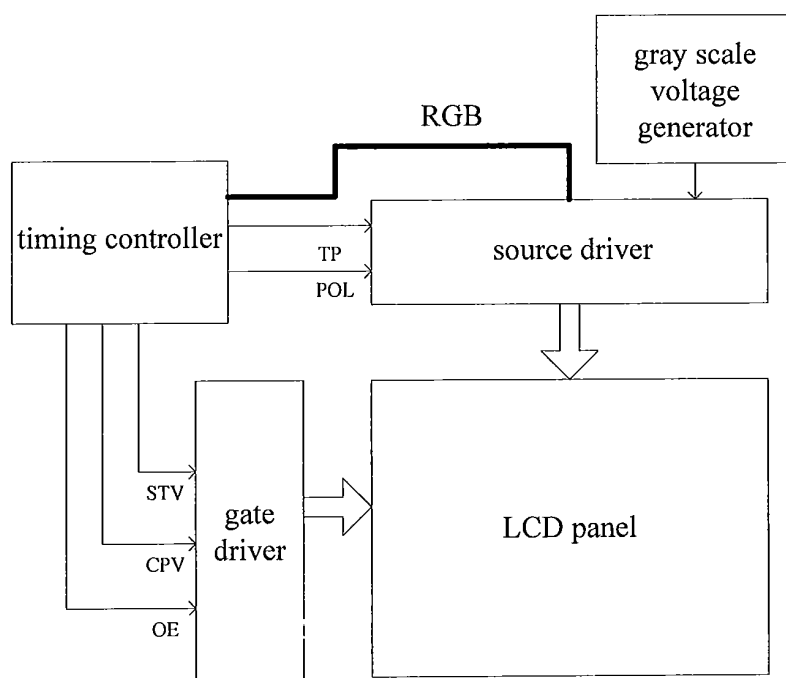


Fig.1

	1	2	3	4	5	6	7	8
1	+	-	+	-	+	-	+	-
2	-	+	-	+	-	+	-	+
3	+	-	+	-	+	-	+	-
4	-	+	-	+	-	+	-	+
5	+	-	+	-	+	-	+	-
6	-	+	-	+	-	+	-	+
7	+	-	+	-	+	-	+	-
8	-	+	-	+	-	+	-	+

Nth frame

	1	2	3	4	5	6	7	8
1	-	+	-	+	-	+	-	+
2	+	-	+	-	+	-	+	-
3	-	+	-	+	-	+	-	+
4	+	-	+	-	+	-	+	-
5	-	+	-	+	-	+	-	+
6	+	-	+	-	+	-	+	-
7	-	+	-	+	-	+	-	+
8	+	-	+	-	+	-	+	-

(N+1)th frame

Fig.2

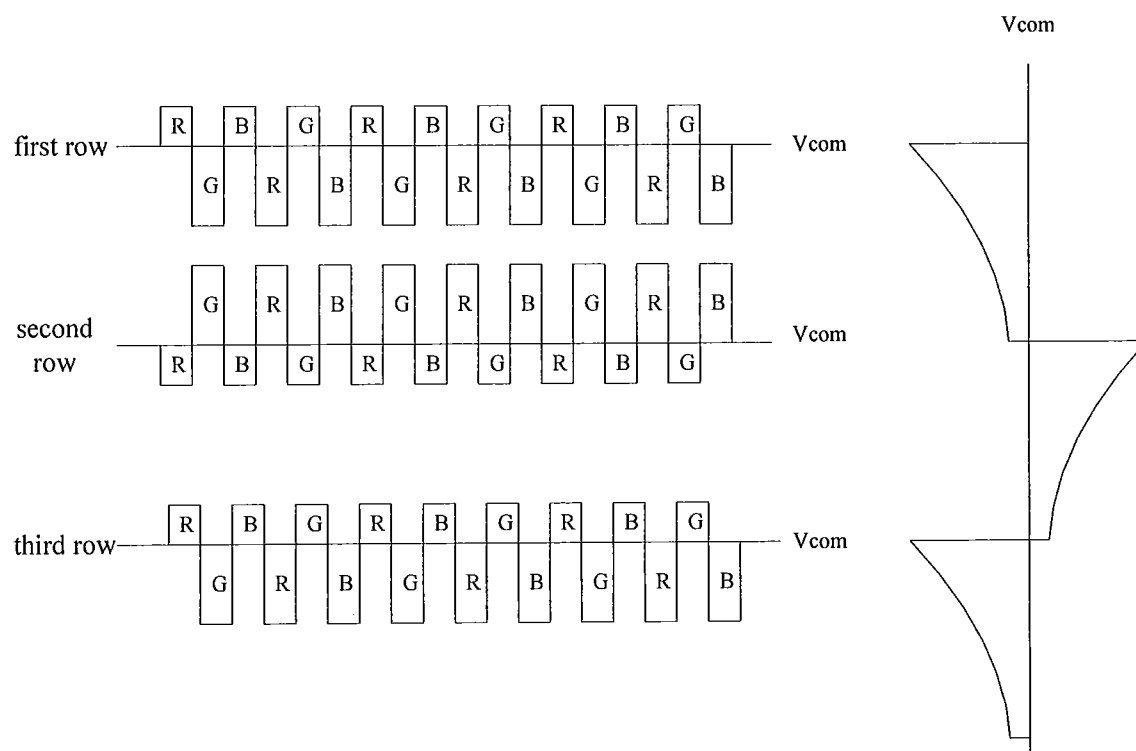


Fig.3

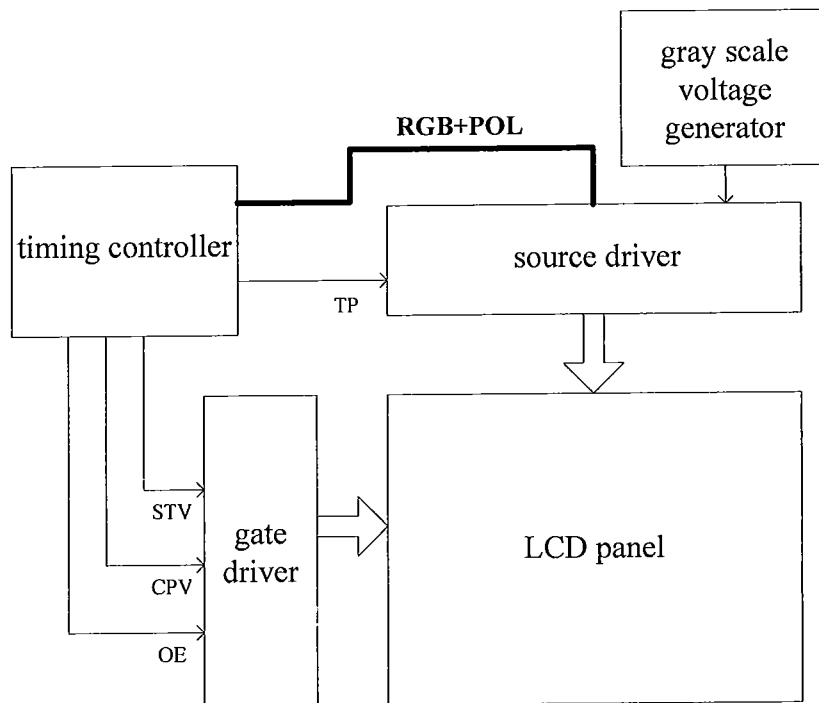


Fig.4

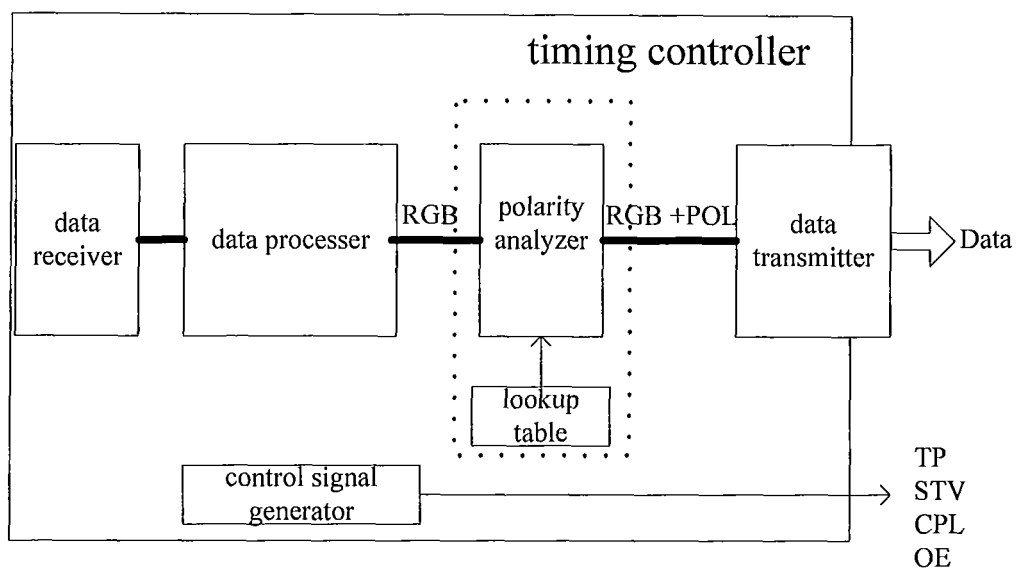


Fig.5

	1	2	3	4	5	6	7	8	9	10	11	12
1	127	0	127	0	127	0	127	0	127	0	127	0
2	127	0	127	0	127	0	127	0	127	0	127	0
3	127	0	127	0	127	0	127	0	127	0	127	0
4	127	0	127	0	127	0	127	0	127	0	127	0
5	127	0	127	0	127	0	127	0	127	0	127	0
6	127	0	127	0	127	0	127	0	127	0	127	0
7	127	0	127	0	127	0	127	0	127	0	127	0
8	127	0	127	0	127	0	127	0	127	0	127	0

Fig.6

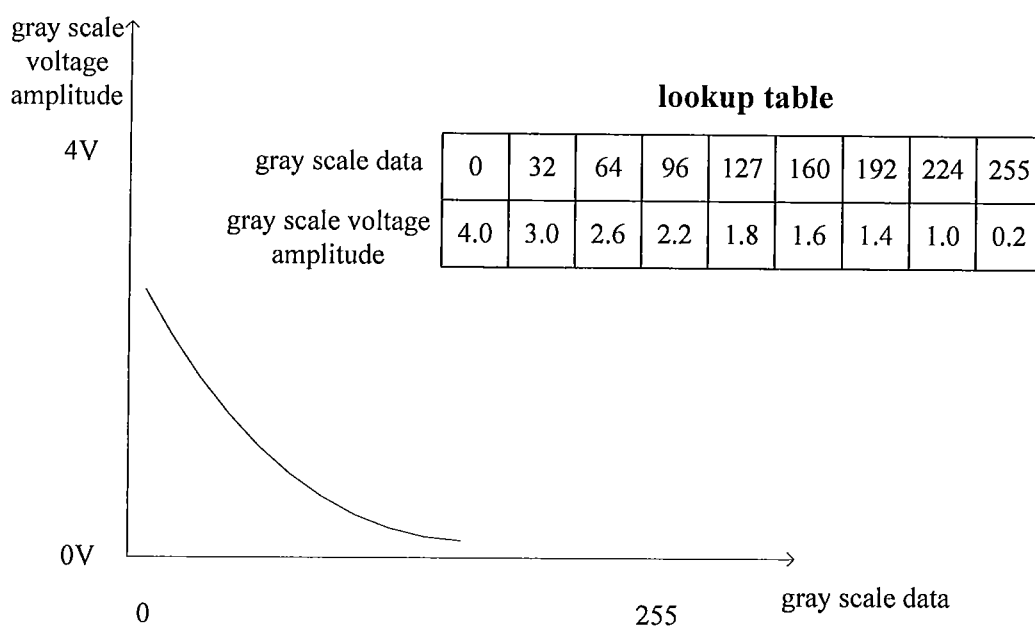


Fig.7

	1	2	3	4	5	6	7	8	9	10	11	12
1	+127	-0	+127	+0	-127	-0	+127	+0	-127	-0	+127	+0
2	-127	+0	-127	-0	+127	+0	-127	-0	+127	+0	-127	-0
3	+127	-0	+127	+0	-127	-0	+127	+0	-127	-0	+127	+0
4	-127	+0	-127	-0	+127	+0	-127	-0	+127	+0	-127	-0
5	+127	-0	+127	+0	-127	-0	+127	+0	-127	-0	+127	+0
6	-127	+0	-127	-0	+127	+0	-127	-0	+127	+0	-127	-0
7	+127	-0	+127	+0	-127	-0	+127	+0	-127	-0	+127	+0
8	-127	+0	-127	-0	+127	+0	-127	-0	+127	+0	-127	-0

Fig.8

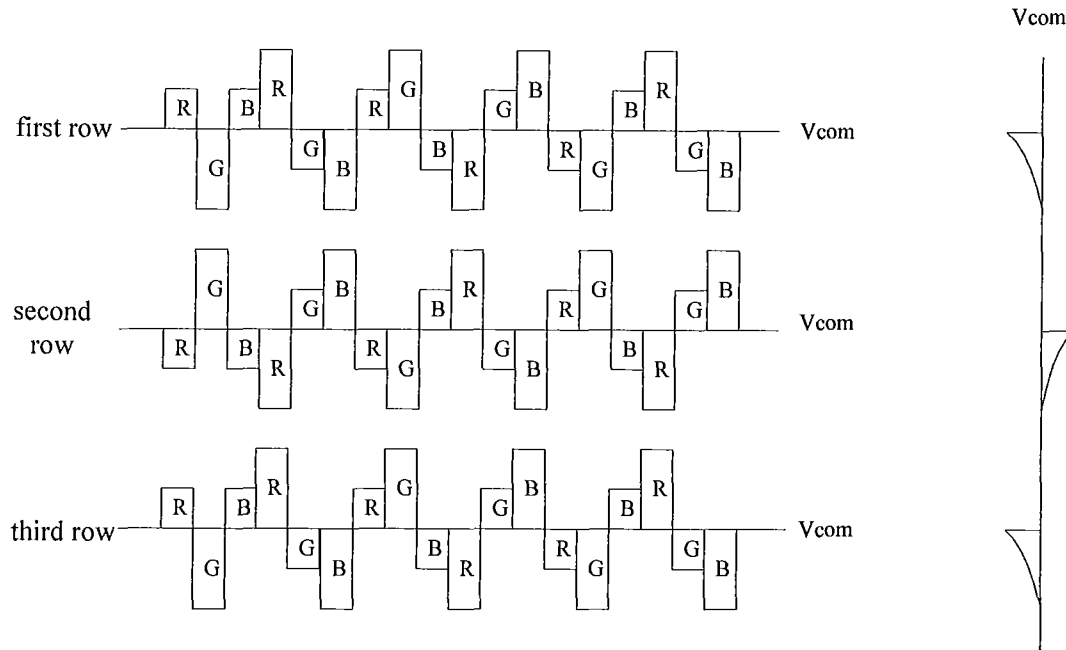


Fig.9

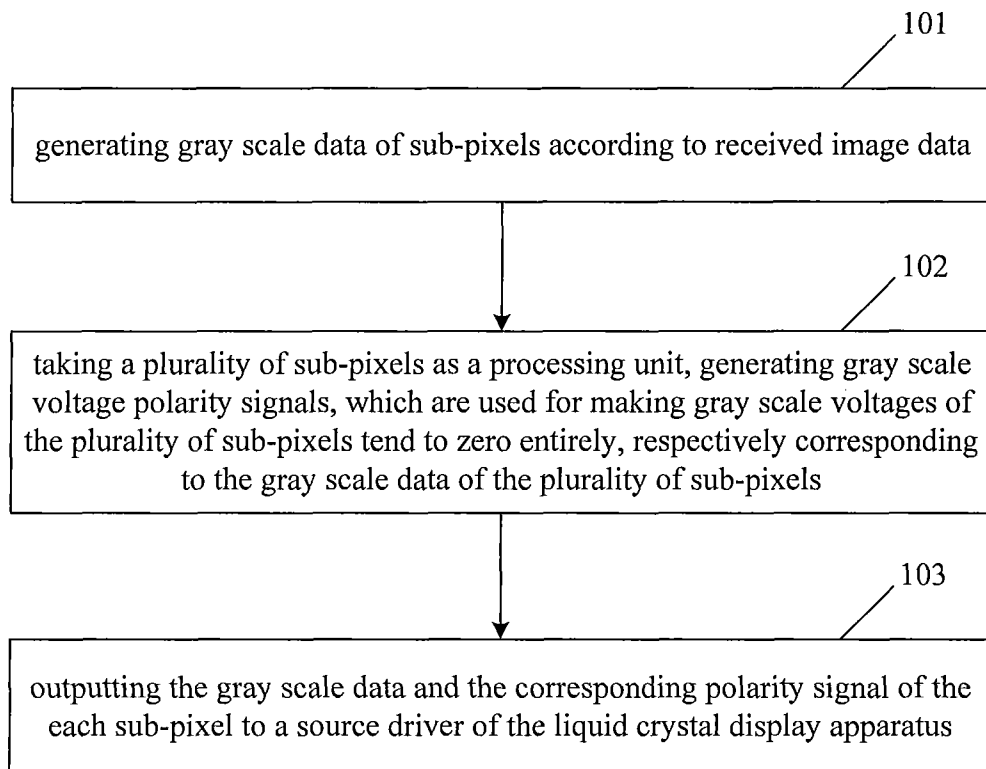


Fig.10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2012062610 A1 [0005]

专利名称(译)	液晶显示装置的驱动方法，装置及液晶显示装置		
公开(公告)号	EP2709097B1	公开(公告)日	2019-11-27
申请号	EP2013182700	申请日	2013-09-02
[标]申请(专利权)人(译)	京东方科技集团股份有限公司 合肥京东方光电科技有限公司		
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IPC分类号	G09G3/36		
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优先权	201210339495.1 2012-09-13 CN		
其他公开文献	EP2709097A2 EP2709097A3		
外部链接	Espacenet		

摘要(译)

本公开提供了一种液晶显示装置和液晶显示装置的驱动方法及装置，属于液晶显示领域。该驱动方法包括：根据接收到的图像数据生成子像素的灰度数据；以多个子像素为处理单元，生成灰度电压极性信号，分别用于使多个子像素的灰度电压整体趋于零，分别用于使多个子像素的灰度电压趋于零。亚像素将每个子像素的灰度数据和对应的极性信号输出到液晶显示装置的源极驱动器。本公开可以改善由公共电压中的湍流引起的显示缺陷，例如绿色附着，串扰，闪烁等。

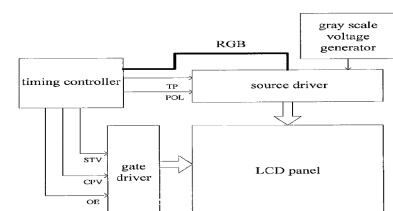


Fig.1

	1	2	3	4	5	6	7	8
1	+	-	+	-	+	-	+	-
2	-	+	-	+	-	+	-	+
3	+	-	+	-	+	-	+	-
4	-	+	-	+	-	+	-	+
5	+	-	+	-	+	-	+	-
6	-	+	-	+	-	+	-	+
7	+	-	+	-	+	-	+	-
8	-	+	-	+	-	+	-	+

Nth frame

	1	2	3	4	5	6	7	8
1	-	+	-	+	-	+	-	+
2	+	-	+	-	+	-	+	-
3	-	+	-	+	-	+	-	+
4	+	-	+	-	+	-	+	-
5	-	+	-	+	-	+	-	+
6	+	-	+	-	+	-	+	-
7	-	+	-	+	-	+	-	+
8	+	-	+	-	+	-	+	-

(N+1)th frame

Fig.2