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(54) REDUCTION OF BURN-IN EFFECTS IN A DISPLAY

(57) The present invention is related to a method, a computer program code, and an apparatus for reducing burn-in effects in a display. The invention is further related to a display and an image generator, which make use of such a method or apparatus. In a first step, an image to be displayed is obtained (10). Furthermore, a target position for the image in a display area is determined (11). The target position varies over time around a nominal position. Then the image is preprocessed (12) for display at the determined target position. Finally, the preprocessed image is output (13) for display.

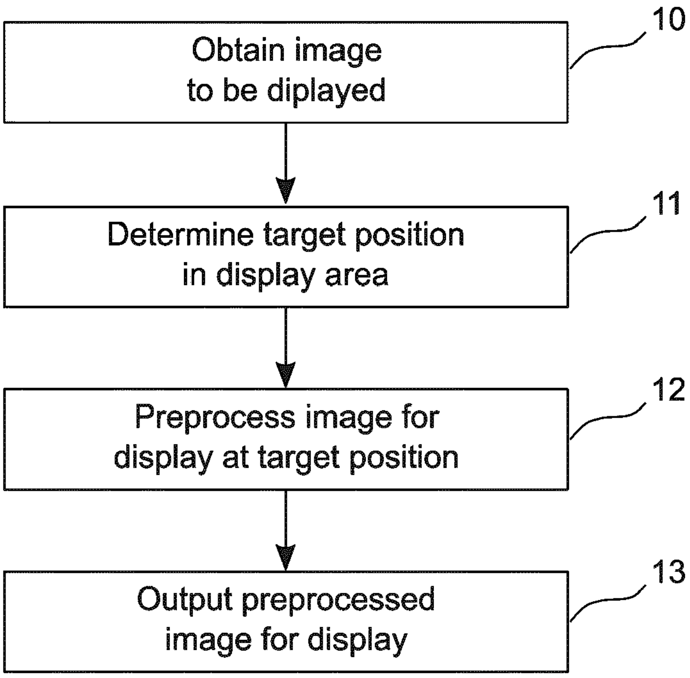

FIG. 1

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Description

[0001] The present invention is related to a method, a computer program code, and an apparatus for reducing burn-in effects in a display. The invention is further related to a display and an image generator, which make use of such a method or apparatus.

[0002] The number, size and resolution of displays that are used in vehicles continuously increase. Currently OLED (Organic Light Emitting Diode) displays are often used in consumer applications, as they provide a very good optical performance and are high in demand by consumers, even considered as a premium add-on. However, they have a major drawback that limits their usability in automotive products, where the same performance has to be delivered for an extended period.

[0003] The main drawback of OLED displays is the relatively quick degradation of the light output as a function of the operation time. This leads to an effect called image burn-in. Assuming some of the display pixels are driven such that they produce a bright image, the aging effect will start to degrade their light output. The longer the pixels are kept in operation, the more their light output will degrade. Because of this, if large parts of the display's surface are turned into a bright state at a later time, e.g. to show a white image, the pixels that already operated for an extended time will appear darker then the surrounding pixels. They will thus be noticeable to the end user as a permanent darker pattern correlated with the previously shown images.

[0004] To overcome this problem, a number of design techniques at the pixel level have been deployed in order to minimize the effect of aging on the brightness level. These techniques imply modifications of the actual pixel construction, the pixel materials or the driving scheme. However, these techniques can only reduce the amount of degradation of the light output versus the operating time, without eliminating the degradation completely.

[0005] For example, US 2017/0069266 A1 discloses a method for compensating luminance degradation of an OLED display. In order to compensate for luminance degradation of a pixel, the capacitance of the pixel is determined. The determined capacitance of the pixel is then correlated to a current correction factor for the pixel. The current correction factor serves as a basis for compensating a pixel drive current, which is used for driving the pixel.

[0006] Empirical analyses show that after an initial period of aging lasting only several hours, in which the degradation follows a non-linear pattern, for the rest of the lifetime of the display, for a constant pixel drive current, the degradation basically shows a linear behavior. Therefore, the maximum light output of a given pixel can be estimated based on its on-time. This offers the possibility to mask the non-uniform degradation of the pixels by logging the on-time of each pixel and adjusting the image that is to be displayed accordingly. For example, parts of the image that are to be seen on the aged pixels can be driven with a higher current in such a way that the resulting brightness matches those parts of the image that are not affected by burn-in. Another possibility is to dim those parts of the image that are to be shown on the non-aged pixels by the same amount as that induced by the aging process for those parts of the image that are to be shown on the aged pixels. Finally, there is also the possibility to use a combination of both approaches.

[0007] Pixel on-time logging may be performed digitally, in a circuit separated from the display, e.g. with the aid of an image processor and a storage device. Alternatively, it may be performed in-cell, directly on the display, e.g. based on the effects on the active pixel's electrical properties caused by aging.

[0008] Even with the described techniques the display lifetime is still limited, as the decrease in brightness of the entire display is governed by the few pixels that are turned on for extended periods of time. For the first approach, where the driving current of the aged pixels is progressively increased during the display lifetime, the design target for the non-aged display must be higher than the required brightness. For instance, if the display has to provide a maximum brightness of 1000 cd/m^2 in normal operation, the design target of the display needs to be set to a higher value, such as 1500 cd/m^2. Since the display brightness is directly correlated with the pixel driving current, the pixel cells must be designed to support a higher operating current. At the beginning of the operational life, all pixels are driven with the current for achieving the target 1000 cd/m^2. However, as the pixels start to degrade, their operating current needs to be increased to compensate the degradation of their light output. This, in turn, accelerates their degradation. As a consequence, their operating current must be increased even further, resulting in an accelerated degradation of the display. If a linear degradation curve is used to assess the display lifetime and yields an estimated useful span of 50000 hours, the actually achievable lifetime may be half or even a quarter of that figure due to the burn-in masking technique, i.e. 10000 to 25000 hours.

[0009] With the second technique for burn-in masking, the achievable lifetime of the display may be properly estimated based on the linear degradation curve, e.g. 50000 hours as in the previous example. However, this approach has the drawback that there will be a continuous degradation of the maximum brightness. Assuming the same condition for the required brightness of 1000 cd/m^2, since this figure must be achieved at least at the end of life of the display, the initial brightness of the non-aged display must still be set to higher value, such as 1500 cd/m^2.

[0010] The third technique, as it consists of a combination of the previous ones, achieves a compromise between the design target brightness and the achievable lifetime. For example, the design target may be relaxed to 1200 cd/m^2 with an achievable lifetime of 25000 to 35000 hours.

[0011] Although the above description focused on

OLED displays, the same considerations apply to all display technologies that are affected by image burn-in.

[0012] It is an object of the present invention to provide solutions for extending the achievable lifetime of displays that use technologies susceptible to burn-in effects.

[0013] This object is achieved by a method for reducing burn-in effects in a display according to claim 1, by a computer program code according to claim 9, and by an apparatus for reducing burn-in effects in a display according to claim 10. The dependent claims include advantageous further developments and improvements of the present principles as described below.

[0014] According to a first aspect, a method for reducing burn-in effects in a display comprises:

- obtaining an image to be displayed;
- determining a target position for the image in a display area, wherein the target position varies over time around a nominal position; and
- preprocessing the image for display at the determined target position.

[0015] Similarly, a computer program code comprises instructions, which, when executed by at least one processor, cause the at least one processor to reduce burn-in effects in a display by performing the steps of:

- obtaining an image to be displayed;
- determining a target position for the image in a display area, wherein the target position varies over time around a nominal position; and
- preprocessing the image for display at the determined target position.

[0016] The term computer has to be understood broadly. In particular, it also includes electronic control units and other processor-based data processing devices.

[0017] The computer program code can, for example, be made available for electronic retrieval or stored on a computer-readable storage medium.

[0018] According to a further aspect, an apparatus for reducing burn-in effects in a display comprises:

- an image retrieving unit for obtaining an image to be displayed;
- a positioning unit for determining a target position for the image in a display area, wherein the target position varies over time around a nominal position; and
- a processing unit for preprocessing the image for display at the determined target position.

[0019] In particular for automotive applications, among others, parts of the display area are used to display the same symbols for extended periods of time. Examples of such symbols are the scales and rings of a speedometer or an odometer. The present solution addresses this issue by reducing the average on-time operation of the pixels of the display. This is achieved by slightly changing the position of the displayed image over the display area. With this approach, the average on-time of the pixels can easily be reduced by a factor of around four. This allows to achieve a lifetime extension for the display by a factor of around two to four.

[0020] Even without a technique for masking the effect of image burn-in, the described technique is capable of achieving a less noticeable image burn-in. This results from the reduction of the average on-time, which, reduces the degradation, and from the effect of image shifting. Image shifting is equivalent to a motion blurring effect, which attenuates the sharp transitions that would otherwise be easily discernible by the end user.

[0021] In one advantageous embodiment, preprocessing the image comprises shifting a display position of the image in the display area. In this case the image itself does not need to be modified, which reduces the required processing capabilities for implementing the solution. Instead, the whole image is moved within the display area. This approach is particularly well-suited for implementation in the display.

[0022] In one advantageous embodiment, preprocessing the image comprises resampling the image over a displaced grid. Also this solution allows to shift the target position around the nominal position. Though the position of the image in the display area does not change, the position of the image content does. This approach is particularly well-suited for implementation in an image generator, i.e. there is no need to modify the display. A further advantage is that image shifts at a fractional pixel level can be achieved.

[0023] In one advantageous embodiment, the target position varies over time at a rate of less than 0,2 pixels per minute. A rate in this range, for instance one pixel per six to ten minutes, is practically unnoticeable to the user.

[0024] In one advantageous embodiment, the display is an OLED-display or a MicroLED-display (LED: Light Emitting Diode). Though the described solution is particularly advantageous for OLED-displays, also other display technologies are affected by burn-in effects and may hence favorably make use of the present invention. For MicroLED-displays also the designations MLED, mLED, and μLED used.

[0025] In one advantageous embodiment, a difference between the target position and the nominal position is smaller than 2 mm. Generally, the larger the maximum difference is chosen, the more the average on-time will be reduced. However, larger shifts may be visible to the user. With a proper design of the human-machine interface on the display and of the instrument that uses the display, image displacements of up to 2 mm can be realized without being noticeable to the end user. For example, it is useful to avoid hard visual reference points and to use black margins on the border of the image to be displayed to conceal the image displacements.

[0026] In one advantageous embodiment, the display is comprised in a head-up display. In this case, the image displacement between the nominal position and the target position may be compensated for by adjusting one or more optical components of the head-up display. In head-up displays the user typically has the possibility to adjust the position of the image in the field of view by mechanical means, e.g. by adjusting the position of one or several mirrors or other optical elements. This possibility may be exploited for the proposed technique for decreasing the average on-time of the pixels. Due to the adjustability the image may be shifted on the display by larger amounts. The image shifts are then compensated before they become noticeable by repositioning the optical elements in the optical path. In this way, for the end user the image remains basically in the same position in the field of view.

[0027] Advantageously, a display comprises an apparatus according to the invention or is configured to perform a method according to the invention. In this case the apparatus does not need to modify the image itself. Instead, the apparatus moves the whole image within the display area.

[0028] Alternatively, an image generator comprises an apparatus according to the invention or is configured to perform a method according to the invention. In this case, the position of the image in the display area does not change, but the position of the image content or part of the image content does. The preprocessed image is then provided to a display, which does not need to be modified.

[0029] Preferably, a display or an image generator according to the invention is used in a vehicle for providing information to a user of the vehicle.

[0030] Further features of the present invention will become apparent from the following description and the appended claims in conjunction with the figures.

[0031] Figures

Fig. 1 schematically illustrates a method for reducing burn-in effects in a display;

Fig. 2 schematically illustrates a first embodiment of an apparatus for reducing burn-in effects in a display;

Fig. 3 schematically illustrates a second embodiment of an apparatus for reducing burn-in effects in a display;

Fig. 4 schematically illustrates an image to be displayed in a display area of a display;

Fig. 5 depicts an example of a cumulative on-time of pixels of a prior art display;

Fig. 6 depicts an example of the cumulative on-time of pixels on a display using the present solution;

Fig. 7 depicts an example of an image degradation of a prior art display caused by burn-in effects; and

Fig. 8 depicts an example of the image degradation of a display using the present solution.

Detailed description

[0032] The present description illustrates the principles of the present disclosure. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the disclosure.

[0033] All examples and conditional language recited herein are intended for educational purposes to aid the reader in understanding the principles of the disclosure and the concepts contributed by the inventor to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions.

[0034] Moreover, all statements herein reciting principles, aspects, and embodiments of the disclosure, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

[0035] Thus, for example, it will be appreciated by those skilled in the art that the diagrams presented herein represent conceptual views of illustrative circuitry embodying the principles of the disclosure.

[0036] The functions of the various elements shown in the figures may be provided through the use of dedicated hardware, programmable logic devices, e.g. FPGAs (Field Programmable Gate Array) or CPLDs (Complex Programmable Logic Devices), as well as hardware capable of executing software in association with appropriate software. When provided by a processor, the functions may be provided by a single dedicated processor, by a single shared processor, or by a plurality of individual processors, some of which may be shared. Moreover, explicit use of the term "processor" or "controller" should not be construed to refer exclusively to hardware capable of executing software, and may implicitly include, without limitation, digital signal processor (DSP) hardware, read only memory (ROM) for storing software, random access memory (RAM), and nonvolatile storage.

[0037] Other hardware, conventional and/or custom, may also be included. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation of program logic, through dedicated logic, through a programmable logic device, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the implementer as more specifically understood from the context.

[0038] In the claims hereof, any element expressed as a means for performing a specified function is intended to encompass any way of performing that function including, for example, a combination of circuit elements that performs that function or software in any form, including, therefore, firmware, microcode or the like, combined with appropriate circuitry for executing that software to perform the function. The disclosure as defined by such claims resides in the fact that the functionalities provided by the various recited means are combined and brought together in the manner which the claims call for. It is thus regarded that any means that can provide those functionalities are equivalent to those shown herein.

[0039] Fig. 1 schematically illustrates a method for reducing burn-in effects in a display. For example, the display may be an OLED-Display or a MicroLED-Display. In a first step, an image to be displayed is obtained 10. Furthermore, a target position for the image in a display area is determined 11. The target position varies over time around a nominal position, preferably at a rate of less than 0,2 pixels per minute. Advantageously, a difference between the target position and the nominal position is smaller than 2 mm. Then the image is preprocessed 12 for display at the determined target position. For example, a display position of the image in the display area may be shifted. Alternatively, the image or parts of the image may be resampled over a displaced grid. Finally, the preprocessed image is output 13 for display. The display may be comprised in a head-up display. In this case, the image displacement between the nominal position and the target position may be compensated for by adjusting one or more optical components of the head-up display.

[0040] Fig. 2 schematically illustrates a block diagram of a first embodiment of an apparatus 20 for reducing burn-in effects in a display 40, e.g. an OLED-Display or a MicroLED-Display. The apparatus 20 has an input 21, via which an image retrieving unit 22 obtains an image to be displayed. A positioning unit 23 determines a target position for the image in a display area. The target position varies over time around a nominal position, preferably at a rate of less than 0,2 pixels per minute. Favorably, a difference between the target position and the nominal position is smaller than 2 mm. The apparatus 20 further has a processing unit 24 for preprocessing the image for display at the determined target position. For example, the processing unit 24 may be configured to shift a display position of the image in the display area. Alternatively, the processing unit 24 may be configured to resample the image over a displaced grid. The preprocessed image is output for display via an output 27 of the apparatus 20. The output 27 may also be combined with the input 21 into a single bidirectional interface. Furthermore, data generated by the apparatus 20 can be stored in a local storage unit 26. The display may be comprised in a head-up display. In this case, the image displacement between the nominal position and the target position may be compensated for by adjusting one or more optical components of the head-up display.

[0041] The image retrieving unit 22, the positioning unit 23 and the processing unit 24 may be controlled by a controller 25. A user interface 28 may be provided for enabling a user to modify settings of the image retrieving unit 22, the positioning unit 23, the processing unit 24, or the controller 25. The image retrieving unit 22, the positioning unit 23, the processing unit 24 and the controller 25 can be embodied as dedicated hardware units. Of course, they may likewise be fully or partially combined into a single unit or implemented as software running on a processor.

[0042] A block diagram of a second embodiment of an apparatus 30 for reducing burn-in effects in a display is illustrated in Fig. 3. The apparatus 30 comprises a processing device 31 and a memory device 32. For example, the apparatus 30 may be a computer or an electronic control unit. The memory device 32 has stored instructions that, when executed by the processing device 31, cause the apparatus 30 to perform steps according to one of the described methods. The instructions stored in the memory device 32 thus tangibly embody a program of instructions executable by the processing device 31 to perform program steps as described herein according to the present principles. The apparatus 30 has an input 33 for receiving data. Data generated by the processing device 31 are made available via an output 34. In addition, such data may be stored in the memory device 32. The input 33 and the output 34 may be combined into a single bidirectional interface.

[0043] The processing device 31 as used herein may include one or more processing units, such as microprocessors, digital signal processors, or a combination thereof.

[0044] The local storage unit 26 and the memory device 32 may include volatile and/or non-volatile memory regions and storage devices such as hard disk drives, optical drives, and/or solid-state memories.

[0045] In the following, a more detailed description of the present approach for reducing burn-in effects in a display shall be given with reference to Fig. 4 to Fig. 8.

[0046] Fig. 4 schematically illustrates an image 50 to be displayed in a display area 41 of a display 40. The image 50 is to be displayed at a nominal position 52 in the display area 41. However, in order to extend the lifetime of the display 40, the actual position of the image 50 is moved over the display area 41 at a very slow pace, for instance one pixel per six to ten minutes. The image 50 is thus not displayed at the nominal position 52, but at a target position 51 that varies over time around the nominal position52. In this way, the average on-time operation of the pixels of the display 40 is reduced. With a proper design of the human-machine interface on the display 40 and of the instrument that uses the display, the system can easily accommodate image displacements of 1 to 2 mm without being noticeable to the end user. For example, it is useful to avoid hard visual reference points and to use black margins to conceal the displacement of the image 50.

[0047] Considering a high-resolution display 40, which is already standard for automotive applications, a typical pixel pitch is around 100 μm. For such a display 40, an image displacement of 2 mm corresponds to a displacement of 20 pixels in each direction. This effectively spreads the on-time of a given pixel over a square covering in total 400 pixels. As a result, the average on-time of a given pixel is reduced by a factor of 400.

[0048] Fig. 5 and Fig. 6 compare the cumulative on-time for a prior art display versus that obtained by applying the proposed algorithm for image shifting in an area of 20 by 20 pixels. In the figures, Fig. 5 depicts the situation of the prior art display 40 whereas Fig. 6 depicts the situation of a display 40 using the present solution. A typical design of a human-machine interface has no or very few pixels that are isolated, i.e. surrounded by large dark areas. In general, around 20 to 100 active pixels are found inside a given square of 20 by 20 pixels. Based on these numbers, the average on-time of the pixels inside the given square is reduced by a factor of 20 to 4, i.e. 400/20 up to 400/100,when the proposed technique is applied.

[0049] The proposed shifting of the image can be performed directly in the display, e.g. by changing the actual position of the received image from time to time. Another possibility is to change the image directly at the generator side by periodically resampling the image over a grid that is slightly displaced. This allows to generate image shifts at a fractional pixel level. The pace of the change can be in the order of one pixel per several minutes. Given the constant distractions in the visual field of the user, it is expected that such slow changes will not be noticeable. However, by shifting the image at fractional pixel levels, but at shorter intervals, the transition between different image positions appears smother. This decreases the risk that the shift is noticed by the user even further.

[0050] Given the cumulative on-time for the display 40, it is possible to estimate the appearance of the burn-in effect on the display surface. Fig. 7 depicts an example of an image degradation of a prior art display 40 caused by burn-in effects. Fig. 8 depicts an example of the image degradation of a display 40 using the present solution. As can be seen from these figures, the proposed technique can decrease the amount of image degradation. Furthermore, the sharp transitions visible in Fig. 7, which can be more easily noticed by the user, are reduced.

Claims

1. A method for reducing burn-in effects in a display (40), the method comprising:

   - obtaining (10) an image (50) to be displayed;
   - determining (11) a target position (51) for the image in a display area (41), wherein the target position (51) varies over time around a nominal position (52); and
   - preprocessing (12) the image (50) for display at the determined target position (51).

2. The method according to claim 1, wherein preprocessing the image (50) comprises shifting a display position of the image in the display area (41).

3. The method according to claim 1, wherein preprocessing the image or parts of the image (50) comprises resampling the image (50) over a displaced grid.

4. The method according to any of the preceding claims, wherein the target position (51) varies over time at a rate of less than 0,2 pixels per minute.

5. The method according to any of the preceding claims, wherein the display (40) is an OLED-Display or a MicroLED-Display.

6. The method according to any of the preceding claims, wherein a difference between the target position (51) and the nominal position (52) is smaller than 2 mm.

7. The method according to any of claims 1 to 5, wherein the display (40) is comprised in a head-up display.

8. The method according to claim 7, further comprising compensating for the image displacement between the nominal position (52) and the target position (51) by adjusting one or more optical components of the head-up display.

9. A computer program code comprising instructions, which, when executed by at least one processor, cause the at least one processor to perform the method of any of claims 1 to 8 for reducing burn-in effects in a display (40).

10. An apparatus (20) for reducing burn-in effects in a display (40), the apparatus (20) comprising:

    - an image retrieving unit (22) for obtaining (10) an image (50) to be displayed;
    - a positioning unit (23) for determining (11) a target position (51) for the image in a display area (41), wherein the target position (51) varies over time around a nominal position (52); and
    - a processing unit (24) for preprocessing (12) the image (50) for display at the determined target position (51).

11. A display (40), wherein the display (40) comprises an apparatus according to claim 10 or is configured to perform a method according to any of claims 1 to 8 for reducing burn-in effects.

12. An image generator, wherein the image generator comprises an apparatus according to claim 10 or is

configured to perform a method according to any of claims 1 to 8 for reducing burn-in effects in a display (40).

13. A vehicle comprising a display (40) according to claim 11 or an image generator according to claim 12 for providing information to a user of the vehicle.

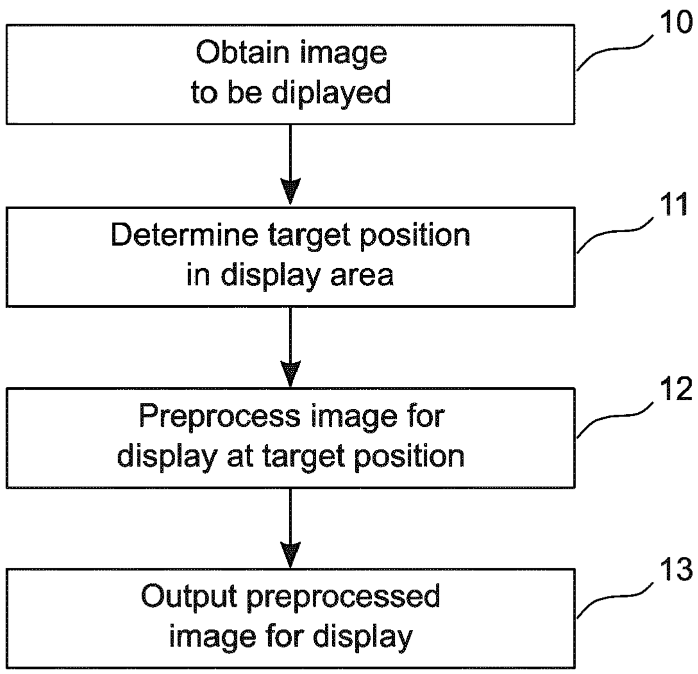
Obtain image
to be diplayed
10
Determine target position
in display area
11
Preprocess image for
display at target position
12
Output preprocessed
image for display
13

FIG. 1

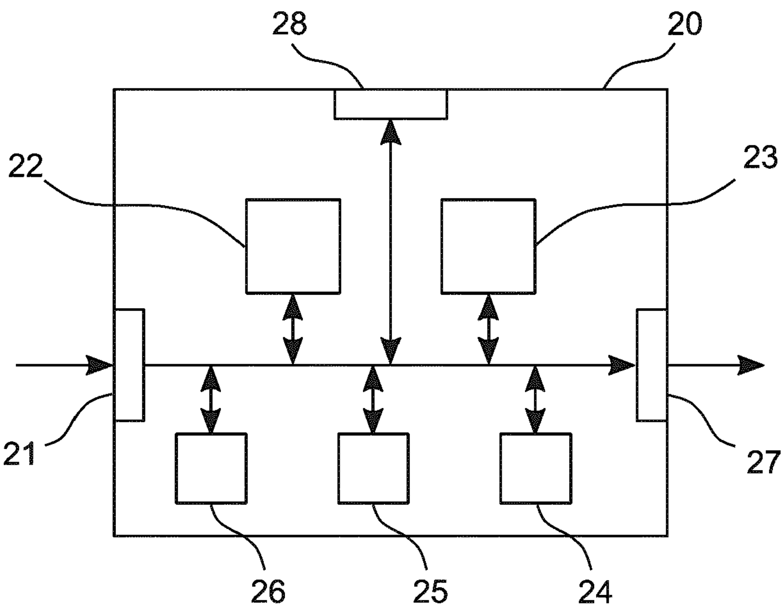
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FIG. 2

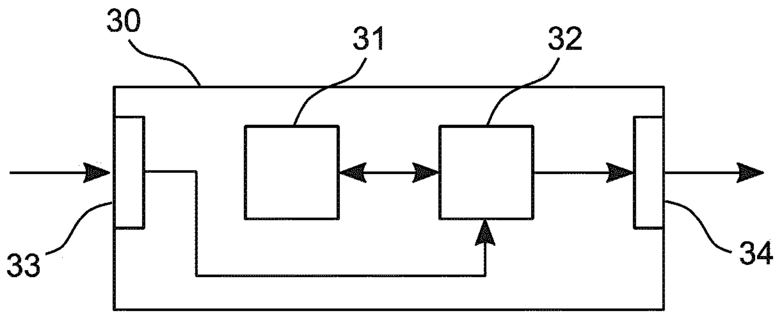

FIG. 3

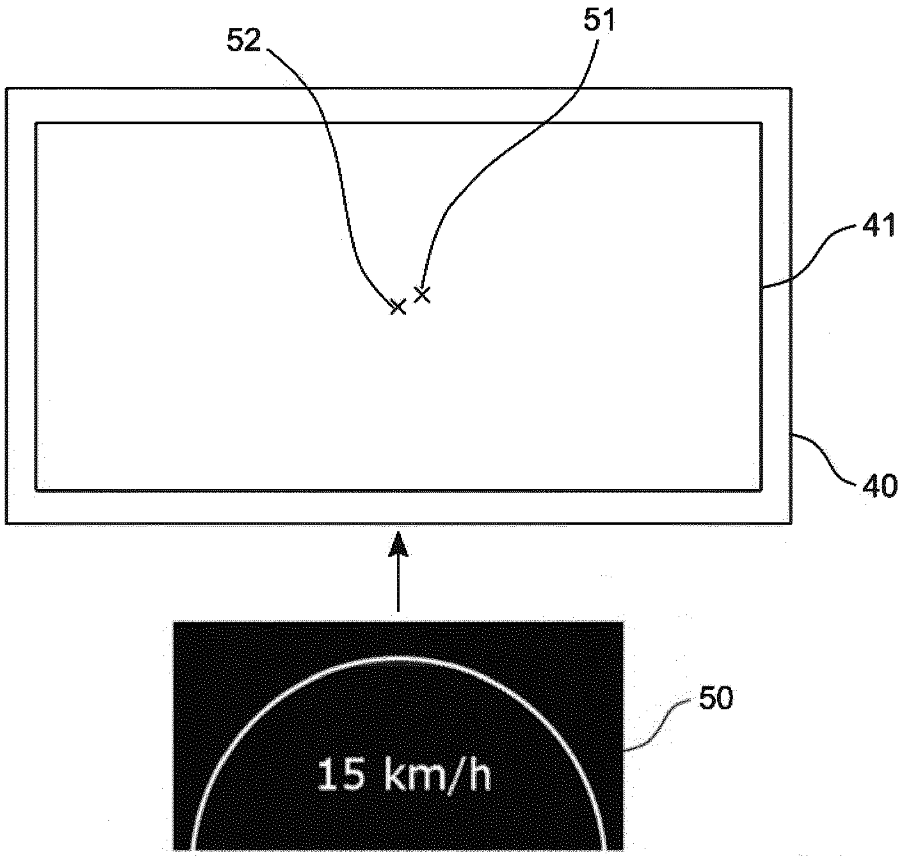

FIG. 4

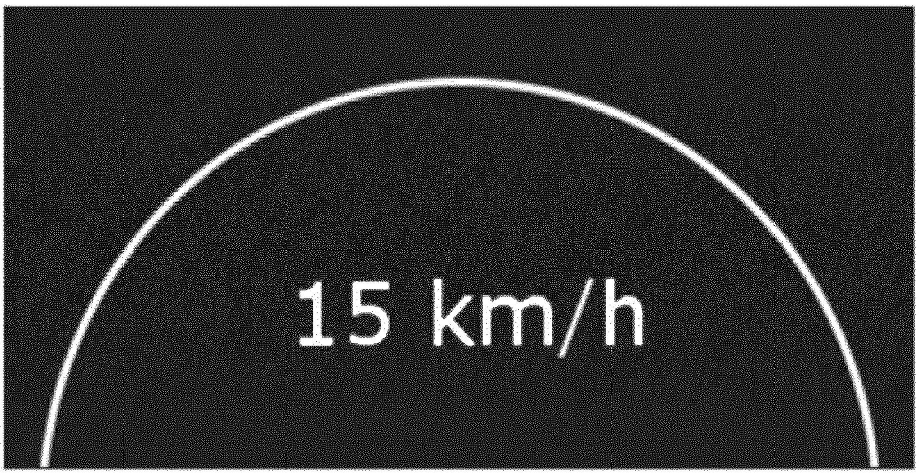

FIG. 5

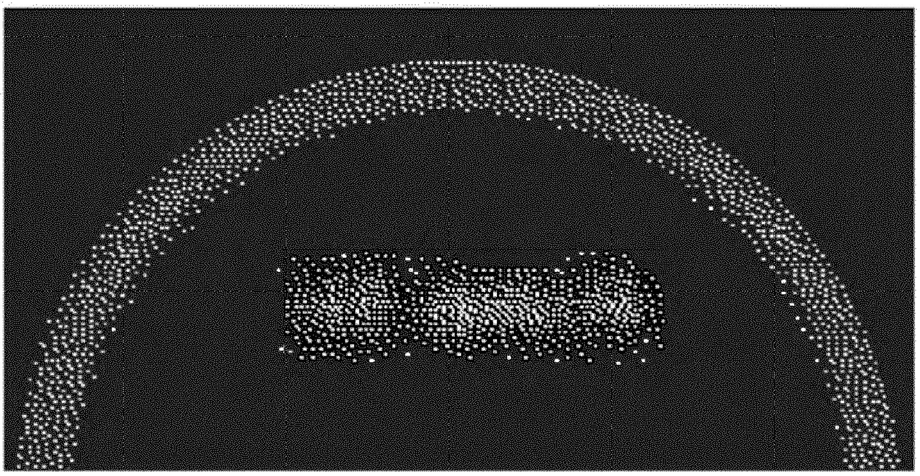

FIG. 6

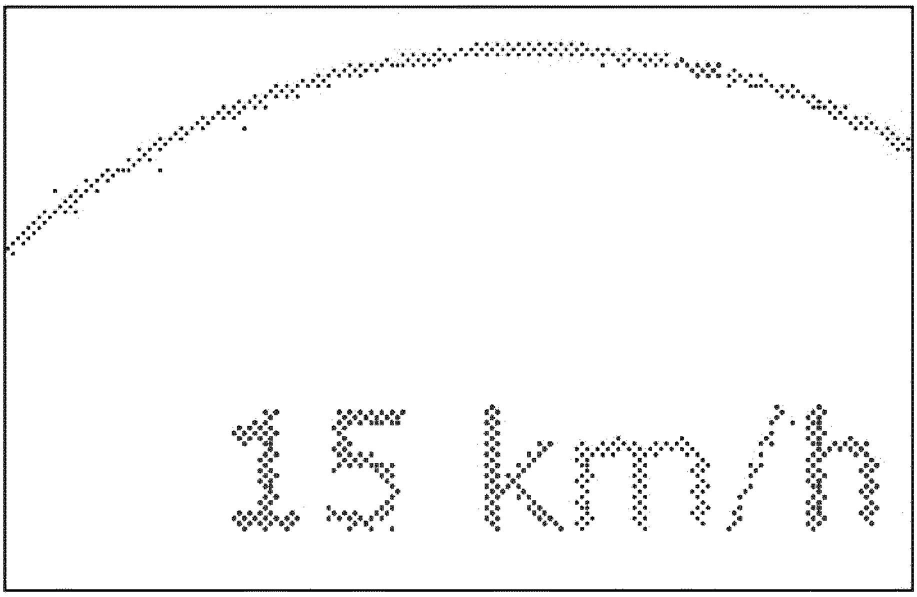

FIG. 7

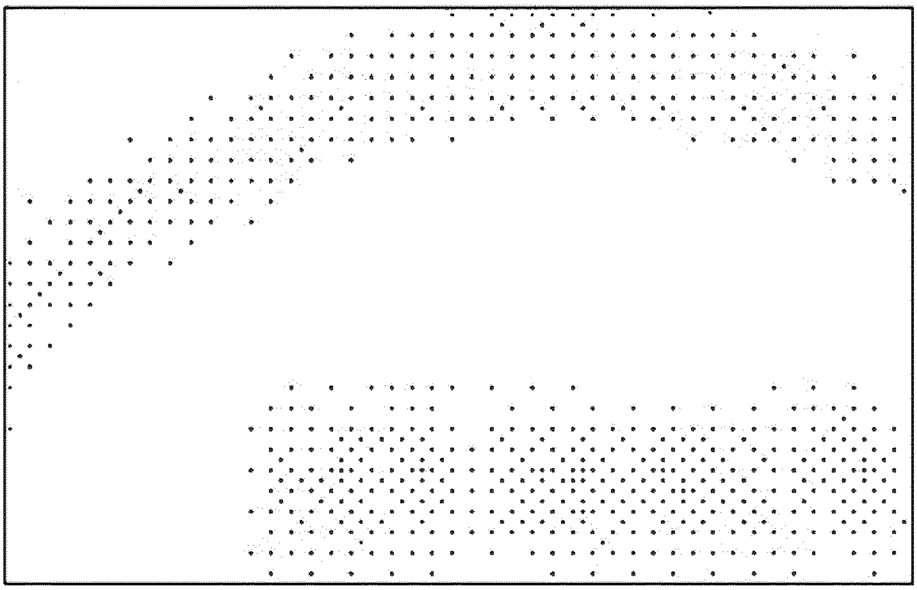

FIG. 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 46 5521

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 2019/027077 A1 (KUDO SHIRO [JP]) 24 January 2019 (2019-01-24) * paragraph [0018] - paragraph [0119]; figures 1-7 * -----	1-5,9-12 6	INV. G09G3/3208
Y	IN H-J ET AL: "A NOVEL FEEDBACK-TYPE AMOLEDS DRIVING METHOD FOR LARGE-SIZE PANEL APPLICATIONS", 1 January 2005 (2005-01-01), 2005 SID INTERNATIONAL SYMPOSIUM DIGEST OF TECHNICAL PAPERS. BOSTON, MA, MAY 24 - 27, 2005; [SID INTERNATIONAL SYMPOSIUM DIGEST OF TECHNICAL PAPERS], SAN JOSE, CA : SID, US, PAGE(S) 252 - 255, XP001244188, * page 252, column 1, line 15 - column 2, line 55 * -----	6	

TECHNICAL FIELDS SEARCHED (IPC)

G09G

1

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	12 June 2019	Harke, Michael

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 19 46 5521

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-6, 9-12

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION SHEET B

Application Number
EP 19 46 5521

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-6, 9-12

   The first invention concerns a method as defined in claim 1, i.e. a method for reducing burn-in effects in a display, the method comprising:- obtaining an image to be displayed;- determining a target position for the image in a display area, wherein the target position varies over time around a nominal position; and- preprocessing the image for display at the determined target position, wherein, as claimed in claim 6, a difference between the target position and the nominal position is smaller than 2 mm.

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2. claims: 7, 8, 13

   The second invention concerns a method as defined in claim 1, i.e. a method for reducing burn-in effects in a display, the method comprising:- obtaining an image to be displayed;- determining a target position for the image in a display area, wherein the target position varies over time around a nominal position; and- preprocessing the image for display at the determined target position, wherein, as claimed in claim 7, the display is comprised in a head-up display.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 19 46 5521

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12-06-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2019027077 A1	24-01-2019	JP 2019023670 A	14-02-2019
		US 2019027077 A1	24-01-2019

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

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