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(54) Title: AMBIENT LIGHT DEPENDENT THEMES

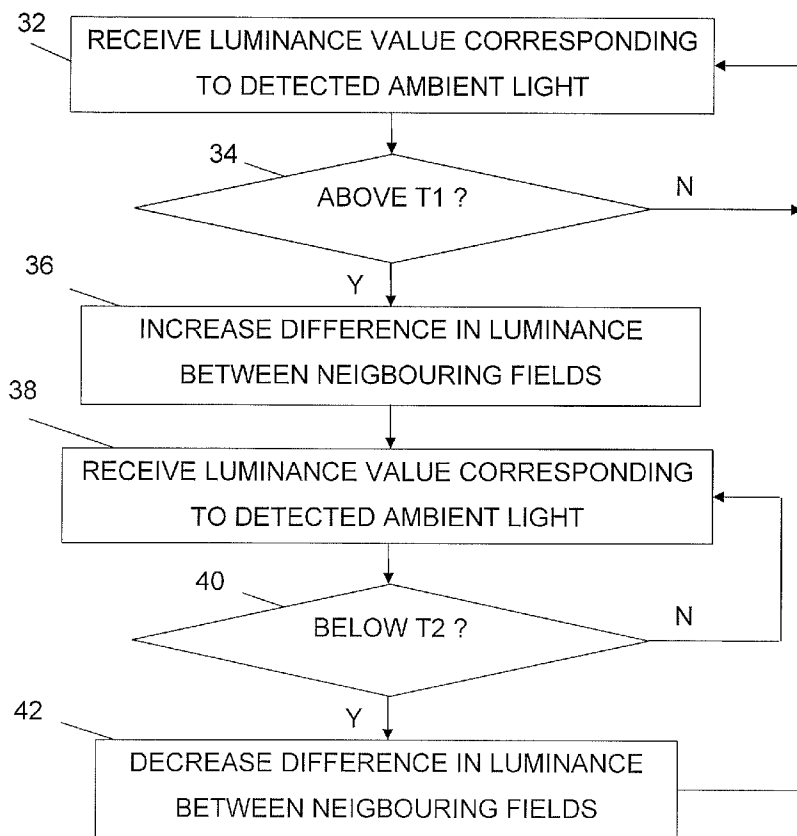


FIG. 3

(57) Abstract: The invention is directed towards a portable electronic device comprising a display as well as to a method and computer program product for adjusting a display displaying an image through providing different colour or grey scale fields. The portable electronic device comprises a display displaying an image through providing different colour or grey scale fields, where neighbouring fields have different luminance, an ambient light detecting unit and a control unit. The control unit receives a luminance value corresponding to detected ambient light from the ambient light detecting unit, compares the luminance value with a first ambient light level threshold and increases the difference in luminance between neighbouring fields of an image displayed by the display in case the threshold is exceeded.

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AMBIENT LIGHT DEPENDENT THEMES

TECHNICAL FIELD OF THE INVENTION

5 The present invention relates to the field of portable electronic devices and more particularly to a portable electronic device comprising a display as well as to a method and computer program product for adjusting a display displaying an image through providing different colour or grey scale fields.

10 DESCRIPTION OF RELATED ART

In portable electronic devices, for instance portable communication devices like cellular phones, there is a widespread use of colour and grey scale displays displaying images to the user of the device. Such displays can nowadays provide sharp images that have
15 many different colours and nuances of colours. However, because of the portability of the device it is frequently used outdoors where a lot of ambient light like sunlight falls onto the display. When this happens the displayed image is in many cases not possible to perceive properly. The various colours and nuances used can then often not be discerned properly by a user. This may lead to information in the image not being conveyed to the user.
20 There is furthermore a waste of energy since a lot of effort is put into displaying various colours and nuances that cannot be separated from each other by a user. There is thus a need for improving on this situation when there is much ambient light.

SUMMARY OF THE INVENTION

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The present invention is directed towards providing a readable display when high ambient light conditions exist.

A first aspect of the present invention is directed towards a portable electronic device
30 comprising:
a display displaying an image through providing different colour or grey scale fields, where neighbouring fields have different luminance,
an ambient light detecting unit, and
a control unit configured to

receive a luminance value corresponding to detected ambient light from the ambient light detecting unit,
compare the luminance value with a first ambient light level threshold, and
increase the difference in luminance between neighbouring fields of an image
5 displayed by the display in case the threshold is exceeded.

A second aspect of the present invention is directed towards a portable electronic device including the features of the first aspect, wherein the control unit when increasing the difference in luminance is configured to change from colour or grey scale to black and
10 white.

A third aspect of the present invention is directed towards a portable electronic device including the features of the first aspect, wherein the control unit is further configured to compare a luminance value with a second ambient light level threshold and to decrease
15 the difference in luminance for neighbouring fields for a previously increased difference in luminance in case the luminance value is below this second threshold.

A fourth aspect of the present invention is directed towards a portable electronic device including the features of the first aspect, wherein the control unit is further configured to
20 also change the image being displayed by the display if the first ambient light level is exceeded.

A fifth aspect of the present invention is directed towards a portable electronic device including the features of the fourth aspect, further comprising at least one circumstance
25 data provision unit, wherein the control unit when being configured to change the image being displayed is configured to receive circumstance data from the circumstance data provision unit and change the image based on the received circumstance data.

A sixth aspect of the present invention is directed towards a portable electronic device
30 including the features of the fifth aspect, wherein one circumstance data provision unit is a clock and the circumstance data associated with this circumstance data provision unit is time data.

A seventh aspect of the present invention is directed towards a portable electronic device
35 including the features of the fifth aspect, wherein one circumstance data provision unit is a

temperature detecting unit and the circumstance data associated with this circumstance provision unit is temperature data.

An eighth aspect of the present invention is directed towards a portable electronic device
5 including the features of the fifth aspect, wherein one circumstance data provision unit is a positioning unit and the circumstance data associated with this circumstance provision unit is position data.

A ninth aspect of the present invention is directed towards a portable electronic device
10 including the features of the first aspect, wherein the display is a liquid crystal display.

A tenth aspect of the present invention is directed towards a portable electronic device including the features of the first aspect, wherein it is a portable communication device.

15 An eleventh aspect of the present invention is directed towards a portable electronic device including the features of the tenth aspect, wherein it is a cellular phone.

A twelfth aspect of the present invention is directed towards a method for adjusting a display displaying an image through providing different colour or grey scale fields, where
20 neighbouring fields have different luminance, comprising the steps of:
receiving a luminance value corresponding to detected ambient light,
comparing the luminance value with a first ambient light level threshold, and
increasing the difference in luminance between neighbouring fields of an image displayed
by the display in case the threshold is exceeded.

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A thirteenth aspect of the present invention is directed towards a method including the features of the twelfth aspect, wherein the step of increasing the difference in luminance comprises changing from colour or grey scale to black and white.

30 A fourteenth aspect of the present invention is directed towards a method including the features of the twelfth aspect, further comprising the steps of comparing a luminance value with a second ambient light level threshold and decreasing the difference in luminance for neighbouring fields for a previously increased difference in luminance in case the luminance value is below this second threshold.

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A fifteenth aspect of the present invention is directed towards a method including the features of the twelfth aspect, further comprising the step of changing the image being displayed by the display if the first ambient light level is exceeded.

5 A sixteenth aspect of the present invention is directed towards a method including the features of the fifteenth aspect, further comprising the step of receiving circumstance data and performing the step of changing the image being displayed based on the received circumstance data.

10 A seventeenth aspect of the present invention is directed towards a method including the features of the sixteenth aspect, wherein the circumstance data includes time data.

An eighteenth aspect of the present invention is directed towards a method including the features of the sixteenth aspect, wherein the circumstance data includes temperature
15 data.

A nineteenth aspect of the present invention is directed towards a method including the features of the sixteenth aspect, wherein the circumstance data includes position data.

20 A twentieth aspect of the present invention is directed towards a computer program product for adjusting a display in a portable electronic device, which display is displaying an image through providing different colour or grey scale fields, where neighbouring fields have different luminance, comprising:

computer program code provided on a data carrier, configured to make the portable
25 electronic device execute, when said program code is loaded in the portable electronic device,
receive a luminance value corresponding to detected ambient light,
compare the luminance value with a first ambient light level threshold, and
increase the difference in luminance between neighbouring fields of an image displayed
30 by the display in case the threshold is exceeded.

The invention has a number of advantages. The invention enables the provision of information that can be seen also when there is a lot of ambient light. The present invention thus improves the readability of a display. The invention is furthermore simple to
35 implement, since many of the units used already exist in the hardware of many portable

electronic devices. The only thing that needs to be added is in this case some new software.

It should be emphasized that the term "comprises/comprising" when used in this
5 specification is taken to specify the presence of stated features, integers, steps or
components, but does not preclude the presence or addition of one or more other
features, integers, steps, components or groups thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

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The present invention will now be described in more detail in relation to the enclosed drawings, in which:

fig. 1 schematically shows a front view of a portable electronic device in the form of a
15 cellular phone,

fig. 2 schematically shows a block schematic of the some parts in the interior of the phone
in fig. 1,

fig. 3 shows a flow chart of a number of method steps being performed in the phone in fig.
1, and,

20 fig. 4 a CD ROM disc on which program code for executing a method according to the
invention is provided.

DETAILED DESCRIPTION OF EMBODIMENTS

25 A portable electronic device according to the present invention will now be described in
relation to a portable communication device in the form of a cellular phone, which is a
preferred variation of such a device according to the present invention. The portable
electronic device may be a portable communication device of some type other type, like a
cordless phone, a PDA, a lap top computer or any other type of portable device
30 communicating with radio waves. It can also be a gaming machine a notepad or any other
type of portable electronic device.

Fig. 1 schematically shows a front view of a phone according to the invention. The phone
10 includes a casing 12 in which there is provided a display 14 and a keypad 16. There is
35 furthermore an ambient light detecting unit 18 which detects the luminance of the ambient

light. The keypad 16 is used for entering information such as making and accepting the reception of phone calls, selection of functions and responding to prompts and the display 14 is used for displaying information to a user of the phone 10, such as icons, functions and prompts. The phone 10 also includes an antenna, which is used for communication with other devices. However the antenna is in-built in the phone 10 and hence not shown in the figure. The phone 10 also includes a speaker for presenting sounds to a user, which speaker is also not shown. The display 14 may here be a colour display and then with advantage an LCD. As an alternative it should be realised that the display may be a grey scale display, i.e. a display showing different nuances of the colour grey.

10

On the display 14 there is here shown an image that is here made up of a number of icons (indicated as rectangles). The image on the display 14 is furthermore made up of a number of colour or grey scale fields, where neighbouring fields have different luminance, where the difference in luminance may be provided as different colours or different nuances of the same colours. One field may here be provided as a part of an icon and a neighbouring field as the background "behind" this icon. It should here also be realised that an icon can include different colours and different nuances of colours. It should also be realised that icons are mere examples of the information that may be presented in an image on a display. A display can present virtually any information in various fields having different colours or nuances of colours. Icons will in the following be used in order to explain the present invention. However the present invention is in no way limited to icons.

Fig. 2 shows a block schematic part of some units in the interior of the cellular phone 10 that may be relevant for the present invention. The phone 10 includes an antenna 26 connected to a communication unit in the form of a radio circuit 28 for enabling radio communication with a network or other devices. The radio circuit 28 is connected to a control unit 20. The control unit 20 is connected to the display 14 and to the keypad 16. The control unit 30 is also connected to the ambient light detecting unit 18 as well as to a number of circumstance data provision units 22, 24 and 30, each arranged to provide circumstance data to the control unit 20. A first circumstance data provision unit 22 is here a clock, a second circumstance data provision unit 24 is here a temperature detecting unit and a third circumstance data provision unit 30 is here a positioning unit, which may be a GPS unit. The first circumstance data provision unit 22 may here receive clock data from a network via the antenna 26 and radio circuit 28 in order to be synchronised with a system clock. The first circumstance data provision unit 22 here provides time data, the

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second circumstance data provision unit 24 here provides temperature data, which is preferably temperature data concerning the ambient temperature, and the third circumstance data provision unit 30 here provides position data, which is data regarding the position of the phone 10. It should here be realised that the present invention may be realised without any or all of the circumstance data provision units. However, they are here provided in order to be used in a variation of the present invention.

In low ambient light conditions, i.e. when the ambient light has low luminance levels, which is often the case indoors or outdoors at night, the image displayed by a display can show many fine details and nuances in various colours. Here the human eye can separate different colour levels even when the difference is small. This means that it is possible to show gradients and use for instance light grey text on dark grey background, which may be perceived by a user without any problems.

However, when a high ambient light condition exists, which is especially the case when using a phone outdoors during a sunny day, the contrast will be reduced and the user can not see the above-mentioned grey scale nuances as well as many other colours and nuances. This is due to the fact that the ambient light is reflected from the display surface. A lot of the information in the image will thus not be perceived by the user. This is a waste both regarding energy consumption as well as regarding the information being presented. The present invention is directed towards improving on this situation.

The functioning of the present invention according to an embodiment will now be described in relation to the previously described fig. 1 and 2 together with fig. 3, which latter figure shows a flow chart of a number of method steps performed in the phone according to a first embodiment of the present invention.

According to the present invention the ambient light detecting unit 18 detects the ambient light. It then provides luminance values corresponding to the detected ambient light to the control unit 20. The control unit 20 thus receives such a luminance value, step 32. The control unit 20 then proceeds and compares the received value with a first ambient light level threshold T_1 , which may be a threshold of 5000 lx. This can be a suitable threshold, since there does not exist any normal indoor conditions with a luminance that is higher than 5000 lx. If this threshold is not exceeded, step 34, the control unit 20 resumes to receive luminance values corresponding to detected ambient light from the ambient light

detecting unit 18. If however the threshold T1 is exceeded, the control unit 20 proceeds and increases the difference in luminance between neighbouring colour or grey scale fields in the image that is being displayed by the display 14, step 36. This may according to one variation of the present invention typically be done through changing the colours or
5 grey scale nuances to black and white or providing neighbouring fields that have luminance that differs considerably from each other. Taking the icons in fig. 1 as an example, some of this change may be performed by increasing the difference in luminance between an icon and the background. Here it is also possible that some differences are evened out so that neighbouring fields that previously had differing
10 luminance now get to have the same luminance, while others get their differences increased. In this way a special ergonomic theme mainly using black and white may be presented to a user of the phone 10. As this has been done the control unit 20 yet again receive a luminance value from the ambient light detecting unit 18, step 38. A received value is then compared with a second lower threshold T2. If then the received value is not
15 below this second ambient light level threshold T2, step 40, the control unit 20 receives another luminance value, step 38, while if it is lower, step 40, the difference in luminance in the image being displayed by the display 14 is decreased, step 42. This decrease may then be a decrease to the same difference that existed before the first level was exceeded so that the same display image that was presented before the increase in luminance
20 difference was performed is again displayed.

In this way it is according to the present invention possible to provide information that can be seen also when there is a lot of ambient light. This means that when readability is low ergonomics are prioritised. This also means that the "good looking"
25 user interface that can be used in a darker environment does not need to be compromised because of the existence of the high ambient light condition. The present invention thus improves the readability of a display. The invention is furthermore simple to implement, since many of the units used already exist in the hardware of many portable electronic devices. The only thing that needs to be
30 added is in this case some new software.

There are a number of variations that can be made to the present invention. It is for instance possible that the above methods is applied as a user starts or turns on the phone, removes a keys lock function, or if a call is received or being made via the
35 radio communication unit. The ergonomic theme could also be used for a displayed

image by a user without comparing luminance values with the first threshold. This may be provided as an option for users having problems identifying the information provided in normal situations.

5 It should here also be mentioned that it is possible that selections are made regarding which information is to be displayed when a high ambient light condition exists. There may thus be a change in the image being displayed. Some icons may for instance be removed, others may be enlarged and some may even be added in a display image. A clock being shown on the display may for instance be enlarged
10 when a high ambient light condition exists. Such a change may for instance be based on the habits of the user, where icons or other data relating to functions often used by the user of the phone may be retained and other icons or other data relating to functions that have not been used frequently may be removed. The information that is to be displayed may as an alternative be decided by circumstance data
15 received from a circumstance data provision unit. Depending on any, some or all of time, position and temperature the control unit may for instance decide if the user is working or not and select which information, for instance which icons, should be presented based on this circumstance data when a high ambient light condition exists. It is furthermore possible that the second threshold is equal to the first
20 threshold. However, they should be separate in order to avoid frequent switching between two levels. As another alternative there may also be several thresholds, which when they are exceeded give rise to different increases in luminance difference. This may be done in order to adapt the display to various high ambient light conditions.

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The control unit according to the present invention is preferably provided in the form of one or more processors with corresponding memory containing the program code for performing its function.

30 The program code mentioned above can also be provided on a data carrier such as a CD ROM disc 44 as depicted in fig. 4 or an insertable memory stick or a USB memory device, which will perform the invention when loaded into a phone having suitable processing capabilities. The program code can also be downloaded remotely from a server.

As has been described above, the present invention can be varied in a multitude of ways. The light detecting unit was for instance described as a separate entity. It should however be realised that it may as an alternative be a part of a camera or a display. Therefore the present invention is only to be limited by the following claims.

CLAIMS

1. Portable electronic device comprising:
a display displaying an image through providing different colour or grey scale
5 fields, where neighbouring fields have different luminance,
an ambient light detecting unit, and
a control unit configured to
receive a luminance value corresponding to detected ambient light from the
ambient light detecting unit,
10 compare the luminance value with a first ambient light level threshold, and
increase the difference in luminance between neighbouring fields of an
image displayed by the display in case the threshold is exceeded.
2. Portable electronic device according to claim 1, wherein the control unit when
15 increasing the difference in luminance is configured to change from colour or
grey scale to black and white.
3. Portable electronic device according to claim 1, wherein the control unit is
20 further configured to compare a luminance value with a second ambient light
level threshold and to decrease the difference in luminance for neighbouring
fields for a previously increased difference in luminance in case the luminance
value is below this second threshold.
4. Portable electronic device according to claim 1, wherein the control unit is
25 further configured to also change the image being displayed by the display if
the first ambient light level is exceeded.
5. Portable electronic device according to claim 4, further comprising at least one
30 circumstance data provision unit, wherein the control unit when being
configured to change the image being displayed is configured to receive
circumstance data from the circumstance data provision unit and change the
image based on the received circumstance data.

6. Portable electronic device according to claim 5, wherein one circumstance data provision unit is a clock and the circumstance data associated with this circumstance data provision unit is time data.
- 5 7. Portable electronic device according to claim 5, wherein one circumstance data provision unit is a temperature detecting unit and the circumstance data associated with this circumstance provision unit is temperature data.
- 10 8. Portable electronic device according to claim 5, wherein one circumstance data provision unit is a positioning unit and the circumstance data associated with this circumstance provision unit is position data.
- 15 9. Portable electronic device according to claim 1, wherein the display is a liquid crystal display.
- 20 10. Portable electronic device according to claim 1, wherein it is a portable communication device.
- 25 11. Portable electronic device according to claim 10, wherein it is a cellular phone.
- 30 12. Method for adjusting a display displaying an image through providing different colour or grey scale fields, where neighbouring fields have different luminance, comprising the steps of:
receiving a luminance value corresponding to detected ambient light,
comparing the luminance value with a first ambient light level threshold, and
increasing the difference in luminance between neighbouring fields of an image displayed by the display in case the threshold is exceeded.
13. Method according to claim 12, wherein the step of increasing the difference in luminance comprises changing from colour or grey scale to black and white.
14. Method according to claim 12, further comprising the steps of comparing a luminance value with a second ambient light level threshold and decreasing the difference in luminance for neighbouring fields for a previously increased

difference in luminance in case the luminance value is below this second threshold.

- 5 15. Method according to claim 12, further comprising the step of changing the image being displayed by the display if the first ambient light level is exceeded.
- 10 16. Method according to claim 15, further comprising the step of receiving circumstance data and performing the step of changing the image being displayed based on the received circumstance data.
17. Method according to claim 16, wherein the circumstance data includes time data.
- 15 18. Method according to claim 16, wherein the circumstance data includes temperature data.
19. Method according to claim 16, wherein the circumstance data includes position data.
- 20 20. Computer program product for adjusting a display in a portable electronic device, which display is displaying an image through providing different colour or grey scale fields, where neighbouring fields have different luminance, comprising
25 computer program code provided on a data carrier, configured to make the portable electronic device execute, when said program code is loaded in the portable electronic device,
receive a luminance value corresponding to detected ambient light,
compare the luminance value with a first ambient light level threshold, and
30 increase the difference in luminance between neighbouring fields of an image displayed by the display in case the threshold is exceeded.

1/2

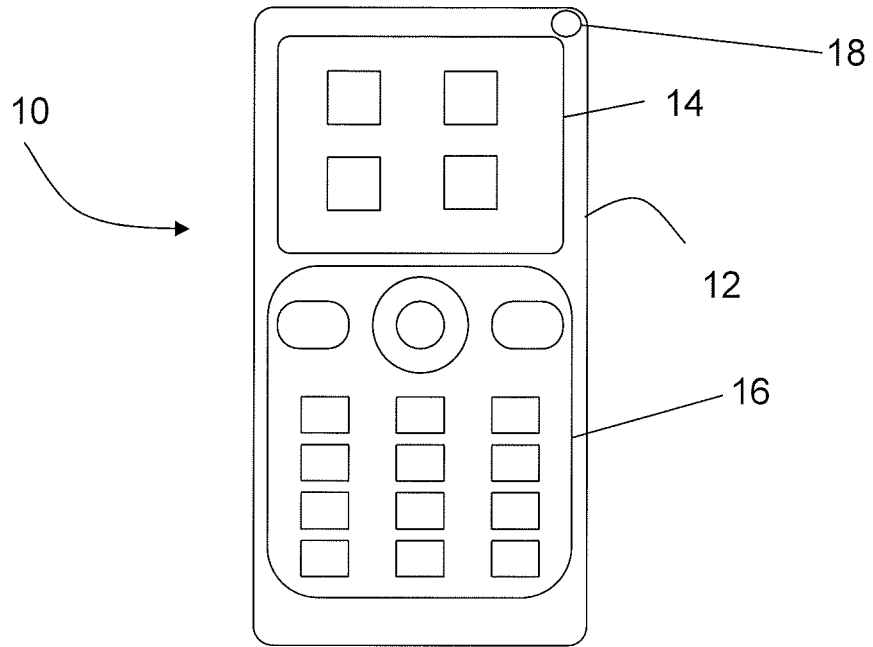


FIG. 1

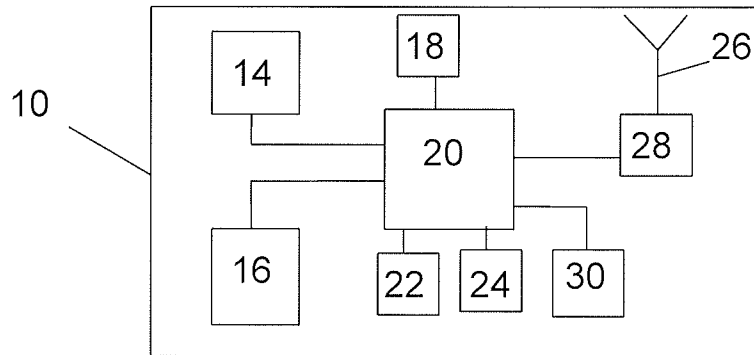


FIG. 2

2/2

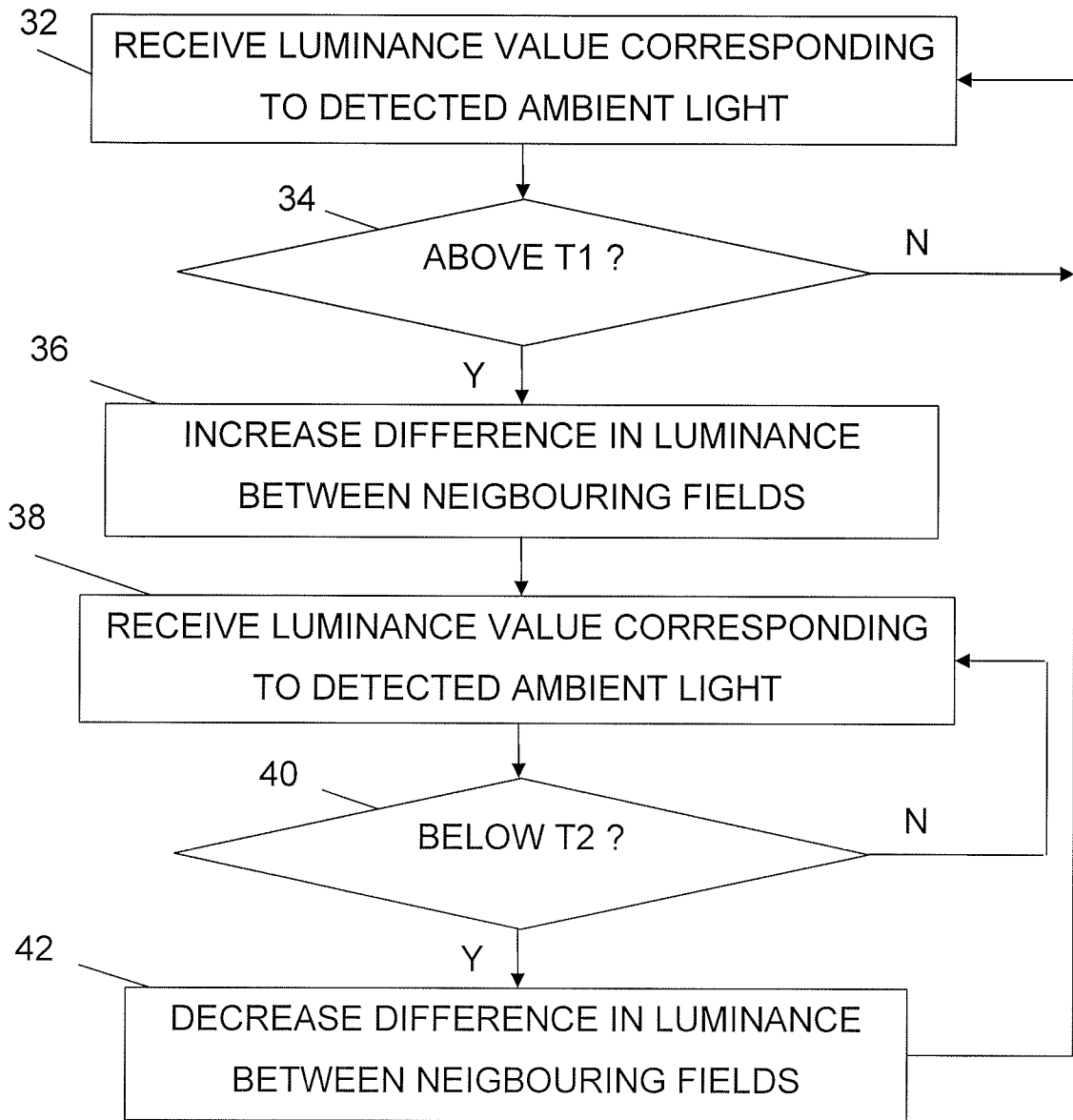


FIG. 3

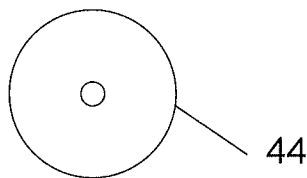


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2008/055220

A. CLASSIFICATION OF SUBJECT MATTER

INV. G09G5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G09G

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

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

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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	-/--	

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

* Special categories of cited documents:

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

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

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

5 August 2008

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14/08/2008

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2008/055220

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