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## (54) Method and user interface for detecting dead pixels in a display device.

(57) Whether a pixel in a displayed image is part of the image or constitutes an inherent error in the structure of a display device is detected by first displaying the image in a first position, and next shifting the image relative to its initial displayed position by at least one pixel in at least one direction.

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## Description

FIELD OF THE INVENTION

**[0001]** The present invention relates to display devices. The invention more particularly relates to a method and a user interface for detecting a dead pixel in a display device.

BACKGROUND OF THE INVENTION

**[0002]** Display devices, more particularly flat panels may have defects known as dead pixels (also called dead points or drop-out points). A dead pixel occurs when a pixel (the smallest block that makes up an image on the screen) becomes locked in a certain state.

**[0003]** For example, a pixel could stay black or white at all times. This defect is known among manufacturers of display devices. Depending on the amount of dead pixels relative to the total amount of displayable pixels that are accepted, flat panel display devices are classified in categories.

**[0004]** For medical applications where a flat panel display is used for displaying a medical image and for performing a diagnosis on the displayed image, only a small number of dead pixels are acceptable since the occurrence of dead pixels may have an influence on the diagnosis.

Especially in mammography where the size of the lesion, e.g. a microcalcification, to be detected on a displayed mammographic image is of the same order of magnitude as that of a dead pixel, dead pixels may at least confuse the radiologist or in the worst case may erroneously be taken as an abnormality or may cover an existing abnormality and make it invisible. Consequentially flat panel displays are not very well accepted as a reliable display device in the field of mammographic diagnosis on screen.

**[0005]** Therefore it would be desirable that the radiologist might be able to determine whether or not a pixel constitutes a dead pixel.

**[0006]** It is therefore an object of the present invention to provide a method and a user interface for detecting whether a pixel in a displayed image is part of the image information itself or constitutes an inherent error in the display device such as a dead pixel.

SUMMARY OF THE INVENTION

**[0007]** The above-mentioned objects are realised by a method having the specific steps set out in claim 1.

**[0008]** In accordance with the present invention, whether a pixel in a displayed image is part of the image or constitutes an inherent error in the structure of a display device is detected by first displaying the image in a first position on the screen, followed by displaying the same image in a second position by shifting the image relative to its initial displayed position by at least one pixel in at least one direction.

**[0009]** In this way one can see whether the alleged dead pixel is indeed a dead pixel and does not move with the image or whether it is part of the image information and hence moves with the image to the second position.

**[0010]** It is sufficient that the image is shifted by one or a small number of pixels to be able to detect whether a pixel constitutes a dead pixel.

**[0011]** For mammographic application, the direction in which the image is shifted is preferably the vertical direction.

This direction is preferred over a shift in the horizontal direction because a shift in the horizontal direction might result in loss of important information at or close to the thorax edge of the mammographic image, which is very important for diagnosis.

**[0012]** Preferably the image is returned to its original position after having been shifted.

**[0013]** The method according to the present invention is applicable to various kinds of display devices among which flat panel display devices such as liquid crystal displays.

**[0014]** The method of the present invention may be implemented in the form of a computer program product, which is for example stored on a computer readable carrier medium such as a CD-ROM.

**[0015]** Another aspect of the invention relates to a user interface in which the user has a means, for example a button on the display screen by means of which a shift of a displayed image can be activated. For example, activation of the button may cause a shift of the displayed image by at least one pixel in a given direction, e.g. the vertical direction.

In one embodiment the user interface provides that the image automatically returns to its start position, alternatively an additional user intervention is required to return the image back into its start position.

In another embodiment means are provided for switching between display of said image in said first and said second position.

## Claims

1. A method of detecting whether a pixel in an image displayed on a display device constitutes a dead pixel **characterised by**
displaying the image in a second position by shifting the image relative to its initial displayed position by at least one pixel in at least one direction.

2. A method according to claim 1 wherein said direction is the vertical direction.

3. A method according to claim 1 additionally comprising the step of displaying the image again in said initial displayed position.

4. A method according to any of the preceding claims wherein said display device is a flat panel display device.

5. A computer program product adapted to carry out the steps of any of claims 1 to 4 when run on a computer.

6. A computer readable carrier medium comprising computer executable program code adapted to carry out the steps of any of claims 1 to 4.

7. A user interface for a display device comprising means for displaying an image in a second position obtained by shifting the image relative to an initial displayed position by at least one pixel in at least one direction.

8. A user interface according to claim 7 comprising means for switching between display of said image in said initial position and said second position.

9. A user interface according to any of claims 6 to 8 wherein said direction is the vertical direction.

10. A display device comprising a user interface according to any of claims 6 - 9.

11. A flat panel display device according to claim 10.

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# EUROPEAN SEARCH REPORT

Application Number
EP 03 10 2642

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
|---|---|---|---|
| X | US 5 790 096 A (HILL JR JACQUES R)<br>4 August 1998 (1998-08-04)<br>* abstract; figure 13B *<br>--- | 1-11 | G09G3/20<br>G09G5/00 |
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

G09G
G01R
H04N
G02F

The present search report has been drawn up for all claims

2

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 13 February 2004 | Amian, D |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 10 2642

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
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13-02-2004

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