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(71) Applicant(s): L & T TECHNOLOGY SERVICES LIMITED

(72) Inventor(s): ABBAS, AKBAR
SAMBAIAH, GUNAKALA
PRASHANTH, RENUKA Y
BALACHANDRA, K
TADIMETY, RAJARAO

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(54) Title: A METHOD AND SYSTEM FOR FLICKER TESTING OF LOADS CONTROLLED BY BUILDING MANAGEMENT DEVICES

(57) Abstract: The invention relates to a method and system for automated flicker testing of a light emitting device. The disclosed method and system captures a plurality of images of the light emitting device using an image capturing device. The image capturing device captures images consecutively in a predefined time interval. The disclosed method and system identifies a region of interest (ROI) for the light emitting device in one image and corresponding region of interests (ROIs) in other images. Further, the identified ROIs are processed. The processing of the ROIs includes converting the grayscale values of the ROIs into corresponding luminance values. A dip in luminance value is determined between the corresponding ROIs in the consecutively captured images and a flicker is identified if the dip in luminance value is greater than a predefined value.

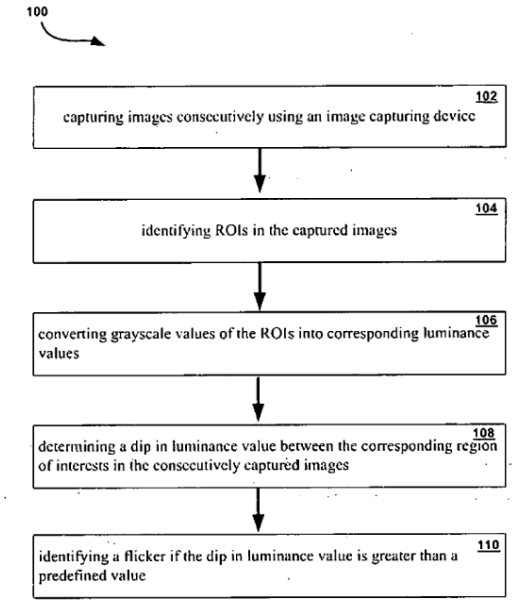


Figure 1

ABSTRACT

A METHOD AND SYSTEM FOR FLICKER TESTING OF LOADS CONTROLLED BY BUILDING MANAGEMENT DEVICES

The invention relates to a method and system for automated flicker testing of a light emitting device. The disclosed method and system captures a plurality of images of the light emitting device using an image capturing device. The image capturing device captures images consecutively in a predefined time interval. The disclosed method and system identifies a region of interest (ROI) for the light emitting device in one image and corresponding region of interests (ROIs) in other images. Further, the identified ROIs are processed. The processing of the ROIs includes converting the grayscale values of the ROIs into corresponding luminance values. A dip in luminance value is determined between the corresponding ROIs in the consecutively captured images and a flicker is identified if the dip in luminance value is greater than a predefined value.

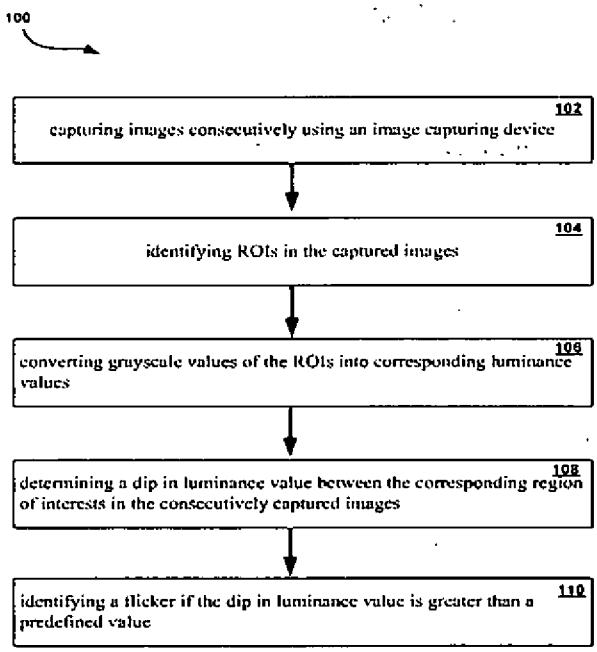


Figure 1

We Claim:

1. A method of automated flicker testing of a light emitting device, the method comprising:

capturing a plurality of images of the light emitting device using an image capturing device wherein the images being captured consecutively in a predefined time interval;

identifying a region of interest for the light emitting device in one image and corresponding region of interests in other images;

processing the region of interest in each of the plurality of images wherein the processing includes converting the grayscale values of the region of interests into corresponding luminance values; and

for each of the plurality of images, determining a dip in luminance value between the corresponding region of interests in the consecutively captured images and identifying a flicker if the dip in luminance value is greater than a predefined value.

2. The method as claimed in claim 1, further comprises, recording time and ambient temperature of the identified flicker.

3. The method as claimed in claim 1, further comprises, calculating duration of the identified flicker by counting number of frames for which there is a dip in the luminance value.

4. The method as claimed in claim 1, wherein the images are captured in real-time.

5. A system for automated flicker testing of a light emitting device, the system comprising:

an image capturing module configured to capture a plurality of images of the light emitting device using an image capturing device wherein the images being captured consecutively in a predefined time interval; and

a test application module configured to process the plurality of images of the light emitting device and generate a test report.

6. The system as claimed in claim 5, further comprising a display component to display the test report.

7. The system as claimed in claim 6, wherein the test report includes flicker test result for the light emitting device.

8. The system as claimed in claim 5, wherein the image capturing module uses an image capturing device.

9. The system as claimed in claim 8, wherein the image capturing device is a camera.

10. The system as claimed in claim 5, wherein the images are captured in real-time.

Dated this 22nd day of March 2016

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai, TN, 600089

FIELD OF INVENTION

The invention generally relates to system and methods for testing light sources and more particularly to flicker testing of the light sources.

BACKGROUND

Flickering is a problem on any of a number of light emitting devices (e.g., in light bulbs, televisions, computers, etc.). In one instance, flicker results from light sources, like incandescent lamps and fluorescent lamps that are powered by alternating current (AC) mains, such as by the light sources being plugged into electrical power outlets. Such light sources can emit light that varies in brightness in correspondence with twice the frequency of the AC mains. This variation in brightness is referred to as flicker.

While the human eye generally does not perceive the flicker of these light sources, the digital images captured by sensors that have successive lines or rows that are exposed at a readout frequency can marred by such flicker in a way that is nevertheless typically immediately and easily perceivable to the human eye. In general, flicker manifests itself in digital images as a series of alternating dark and light bands corresponding to the variation in brightness of the light emitted by the light sources.

To overcome this problem, many types of digital image capturing devices attempt to detect flicker so that it can be compensated for either during the capture of a digital image, or after the capture of the digital image via some type of post-capture digital image processing.

However, detecting flicker can be difficult. For instance, some types of scenes captured in digital images may have patterns that may be erroneously detected as flicker.

Therefore, there may a need for an automated and improved system and method for performing the flicker detection. The present invention is directed to overcome one or more of the problems as set forth above.

SUMMARY OF THE INVENTION

Exemplary embodiments of the invention disclose a method and system for automated flicker testing of a light emitting device. According to an embodiment of the invention, a system and method for automated flicker testing of a light emitting device using an image capturing device is disclosed. According to an exemplary embodiment, the disclosed system and method captures a plurality of images of the light emitting device using an image capturing device wherein the images are captured consecutively in a predefined time interval. A region of interest (ROI) for the light emitting device is identified in one image and corresponding region of interests (ROIs) in other images. The region of interest is processed in each of the plurality of images wherein the processing of the region of interests includes converting the grayscale values of the ROIs into corresponding luminance values. For each of the plurality of captured images, a dip in luminance value is determined between the corresponding region of interests in the consecutively captured images and a flicker is identified if the dip in luminance value is greater than a predefined value.

According to an embodiment, time and ambient temperature of the identified flicker is recorded. The duration of the identified flicker is calculated by counting number of frames for which there is a dip in the luminance value.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings, wherein like reference numerals denote corresponding parts throughout the several views:

Figure 1 illustrates a block diagram of a process for automated flicker testing of a light emitting device, according to an exemplary embodiment of the invention; and

Figure 2 illustrates an exemplary system for automated flicker testing of a light emitting device, according to one embodiment of the invention.

DETAILED DESCRIPTION OF DRAWINGS

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments of the invention as defined by the claims and their equivalents. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

According to embodiments of the invention, a system and method for automated flicker testing of a light emitting device is disclosed.

FIG. 1 illustrates a block diagram of the process 100 for automated flicker testing of a light emitting device according to an embodiment of the invention. The terms light emitting device and light source may be used interchangeably. At step 102, a plurality of images of the light emitting device is captured using an image capturing device. According to an embodiment, the images may be captured consecutively in a pre-defined time interval.

According to an exemplary embodiment, the image capturing device may be a camera. The camera may be a smart camera capable of running image processing algorithms. The smart camera may have image processing algorithms running on FPGA of the camera. According to another embodiment, the camera may capture images of the light emitting device with a speed of 40 frames/second. According to yet another embodiment, the camera may capture images at a speed varying from 1 to 4000 frames per second. According to a further embodiment, the camera may capture the images in real time.

According to an embodiment, the image capturing device may send the captured images to an application running on a computer. According to an exemplary embodiment, the test application may run on a windows machine over a real time engine. According to another embodiment, the image capturing device may be connected to the computer running the test application via Ethernet.

At step 104, a region of interest (ROI) for the light emitting device is identified in one image and corresponding region of interests (ROIs) in other images. According to an embodiment, the test application may identify the ROI for the light emitting device in each of the captured images. According to another embodiment, the ROIs may be extracted as separate images.

At step 106, the grayscale values of the ROIs are converted into corresponding luminance values. According to an embodiment, the test application may convert the grayscale values of the ROIs of the light emitting device into corresponding luminance values.

At step 108, a dip in luminance value is determined between the corresponding ROIs in the consecutively captured images. According to an embodiment, the test application may compute a dip in luminance value of the corresponding ROIs.

At step 110, a flicker is identified if the dip in luminance value is greater than a predefined value. According to an embodiment, the predefined value may be a standard value. According to another embodiment, the predefined value may specify a range of values.

According to an exemplary embodiment, a report is generated by the test application with flicker test results for the light emitting device.

The process 100 may be extended for automated flicker testing of a plurality of light emitting devices according to an embodiment of the invention.

According to an embodiment, all the image processing steps mentioned in Fig. 1 may be performed by an image capturing device such as, but not limited to, a smart camera.

According to another embodiment, current consumption of the light emitting device is monitored with a digital ammeter interfaced with the test application.

FIG. 2 illustrates an exemplary system 200 for automated flicker testing of the light emitting device, according to one embodiment of the present invention.

The disclosed system 200 may include an image capturing module 202, test application module 204 and display device 208.

The image capturing module 202 may include an image capturing device to capture images of the light emitting device. According to an embodiment, the image capturing device may be a camera. According to another embodiment, the image capturing device may capture the images consecutively in a pre-defined time interval. According to an exemplary embodiment, the camera may capture the images with a speed of 40 frames/second.

According to an embodiment, the image capturing device may be a smart camera. The smart camera may have image processing algorithms running on FPGA of the camera. According to yet another embodiment, the image capturing device captures live image of the light emitting device. The image capturing device may send the captured images to a test application module 204.

The test application module 204 may have a test application running on a windows machine over a real time engine. The test application may perform flicker testing of the light emitting device.

The test application module 204 may include a processor 206. The processor 206 may identify a region of interest in one image and corresponding region of interests in other captured images. According to an embodiment, the processor 206 may extract the ROIs as separate images. The processor 206 may further convert the grayscale values of the ROIs into corresponding luminance values.

According to an embodiment, the image processing steps performed by the processor 206 of the test application module may be carried out at the image capturing module 202.

The processor 206 may further calculate a dip in luminance value between the corresponding ROIs in the consecutively captured images.

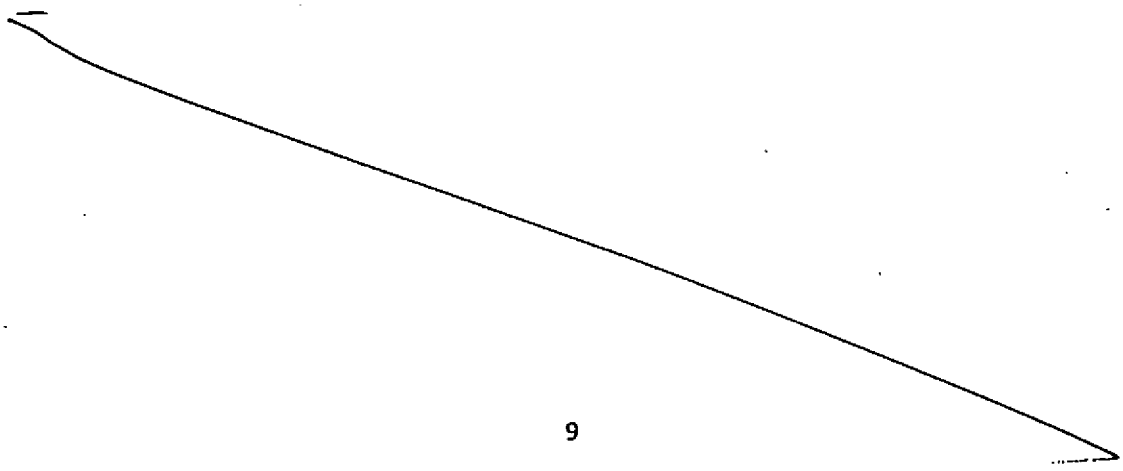
Furthermore, the processor 206 may identify a flicker if the dip in luminance value is greater than a predefined value. According to an embodiment, the predefined value may be a standard value. According to another embodiment, the predefined value may specify a range of values.

According to an exemplary embodiment, the processor 206 may generate a report with flicker test results for the light emitting device. As the invention may be extended to a plurality of light emitting devices, accordingly, the report may include flicker test results of the plurality of light emitting devices. According to an embodiment, the processor 206 may display the report on a display device 208 such as but not limited to Cathode ray tube display (CRT), Light-emitting diode display (LED), Electroluminescent display (ELD), Plasma display panel (PDP) etc. According to another embodiment, the display may include a graphical user interface (GUI).

In the drawings and specification there has been set forth preferred embodiments of the invention, and although specific terms are employed, these are used in a generic and descriptive sense only and not for purposes of limitation. Changes in the form and the proportion of parts, as well as in the substitution of equivalents, are contemplated as circumstances may suggest or render expedient without departing from the spirit or scope of the invention.

Throughout the various contexts described in this disclosure, the embodiments of the invention further encompass computer apparatus, computing systems and machine-readable media configured to carry out the foregoing systems and methods. In addition to an embodiment consisting of specifically designed integrated circuits or other electronics, the present invention may be conveniently implemented using a conventional general purpose or a specialized digital computer or microprocessor programmed according to the teachings of the present disclosure, as will be apparent to those skilled in the computer art.

Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those skilled in the software art. The invention may also be implemented by the preparation of application specific integrated circuits or by interconnecting an appropriate network of conventional component circuits, as will be readily apparent to those skilled in the art.



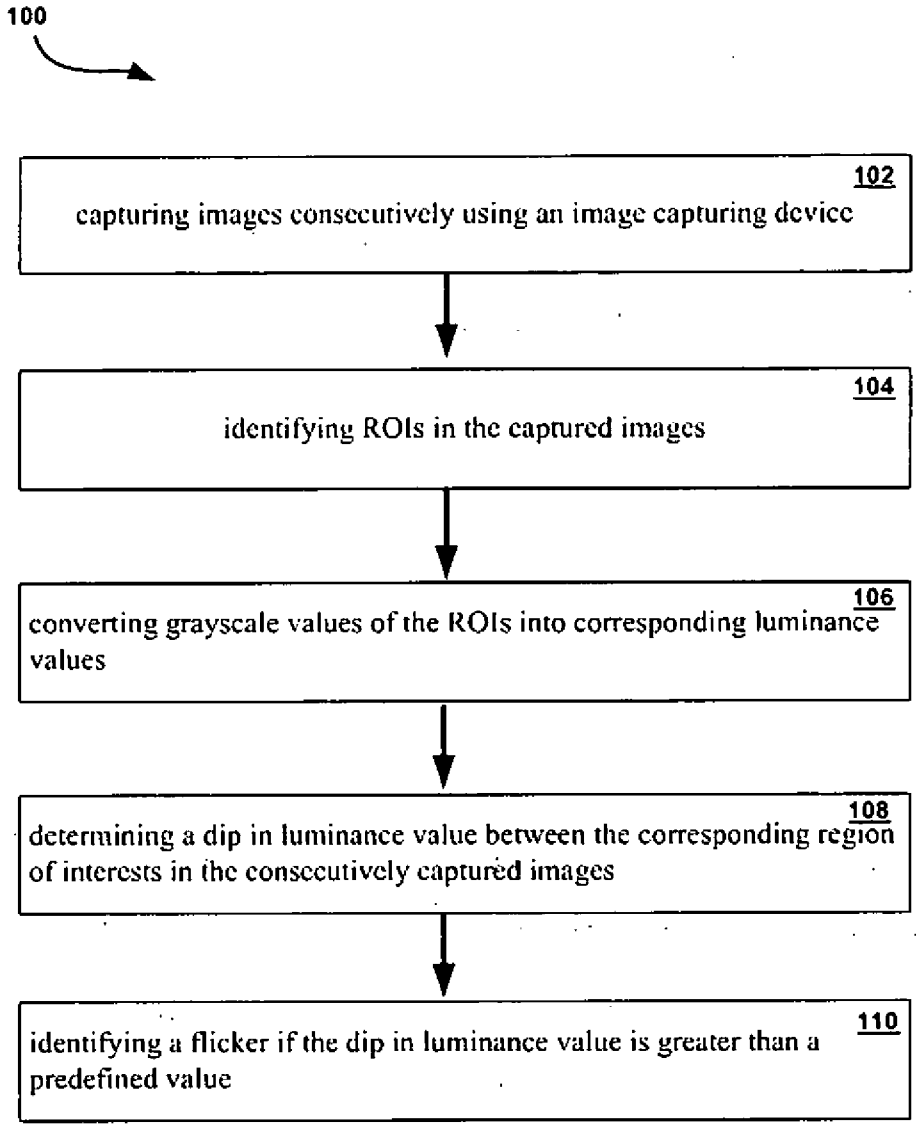


Figure 1

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089

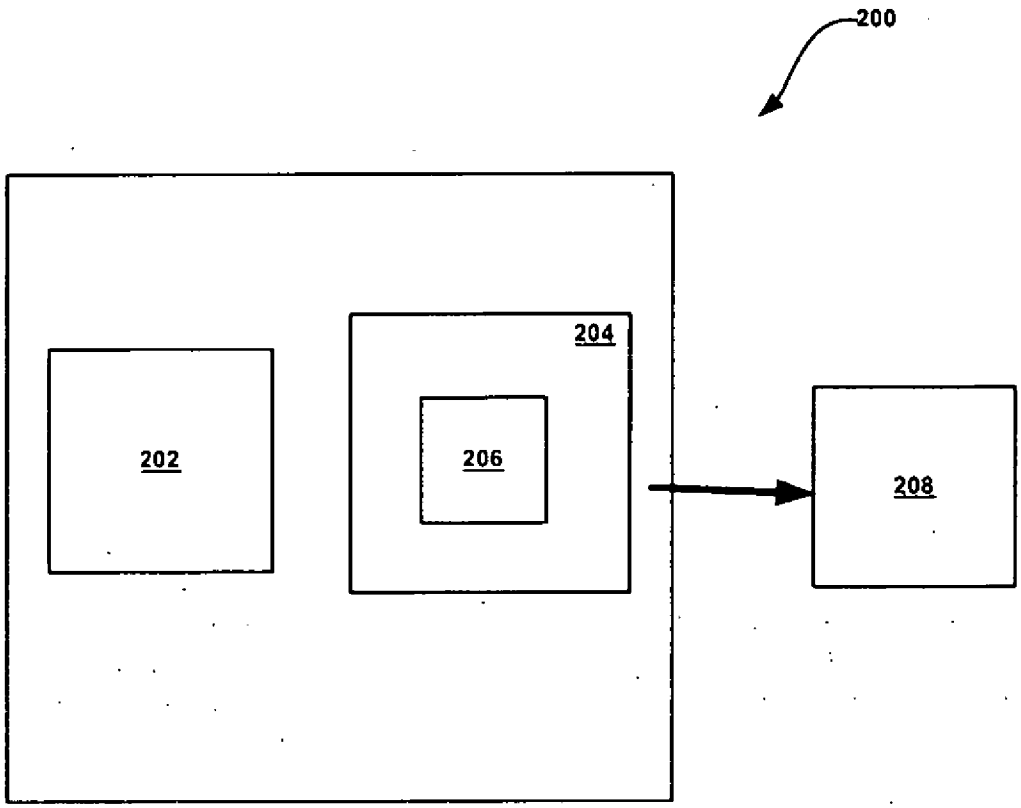


Figure 2

Mohammed Faisal (INPA No: 1941)
Head, IPR Dept.
L&T Technology Services Limited
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai – 600089