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(54) **CAMERA WITH DUST CHECKING FUNCTION**

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G01N 21/88	(2006.01)

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USPC 348/241, 247, 254, 252, 245, 187; 382/162, 163, 165; 702/35

See application file for complete search history.

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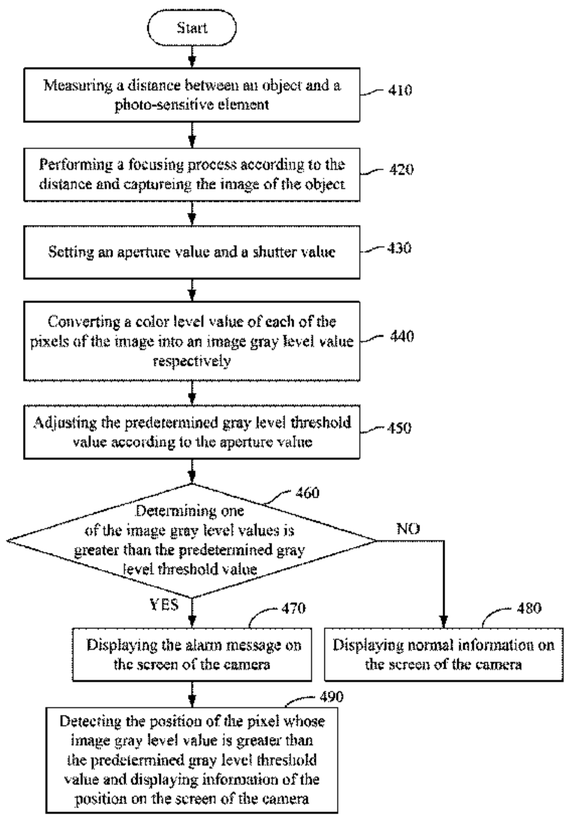
(57) **ABSTRACT**

A camera includes a photo-sensitive element and a controller. The controller is electrically connected to the photo-sensitive element. The photo-sensitive element is configured to capture an image of an object. The controller is configured to convert a color level value of each of pixels of the image into an image gray level value, and the controller is configured to generate an alarm message to display on a screen of the camera when one of the image gray level values is higher than a predetermined gray level threshold value.

7 Claims, 4 Drawing Sheets



(51) **Int. Cl.**

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H04N 5/217	(2011.01)
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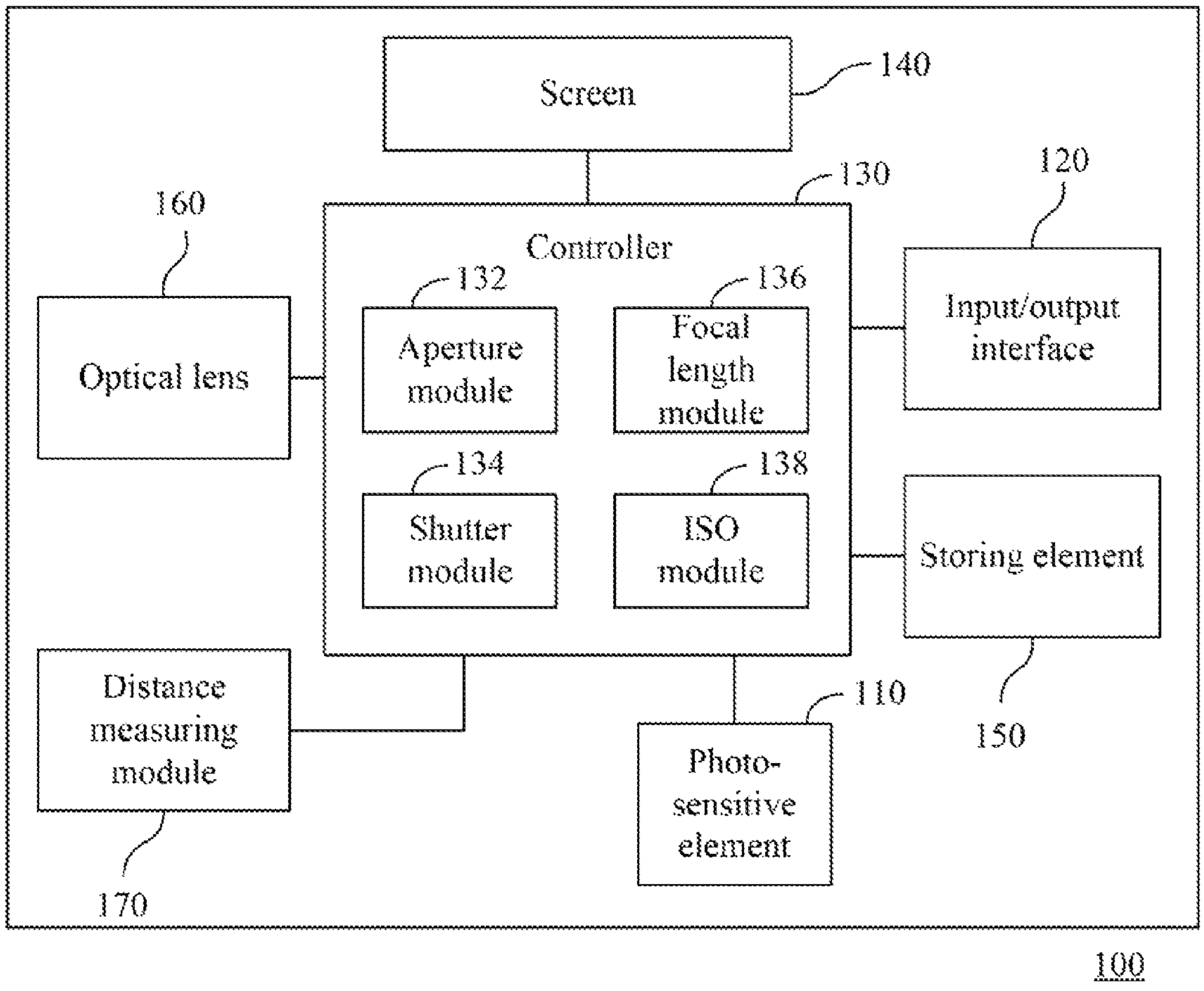
Screen
140
130
120
160
Controller
132
136
Optical lens
Aperture module
Focal length module
Input/output interface
134
138
Shutter module
ISO module
Storing element
Distance measuring module
110
Photo-sensitive element
150
170
100

Fig. 1

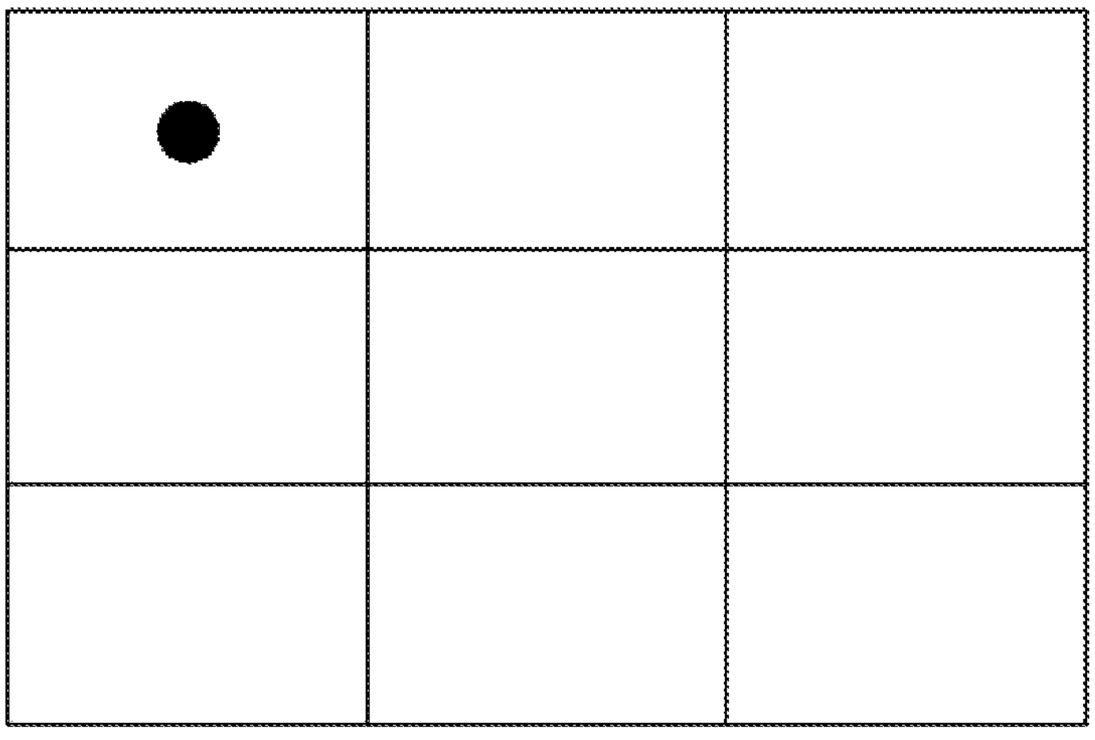

Fig. 2

Start
Capturing an image of an object using a photo-sensitive element
310
Converting a color level value of each of a plurality of pixels of the image into an image gray level value
330
Displaying an alarm message on a screen of the camera when one of the image gray level values is higher than a predetermined gray level threshold value
350

Fig. 3

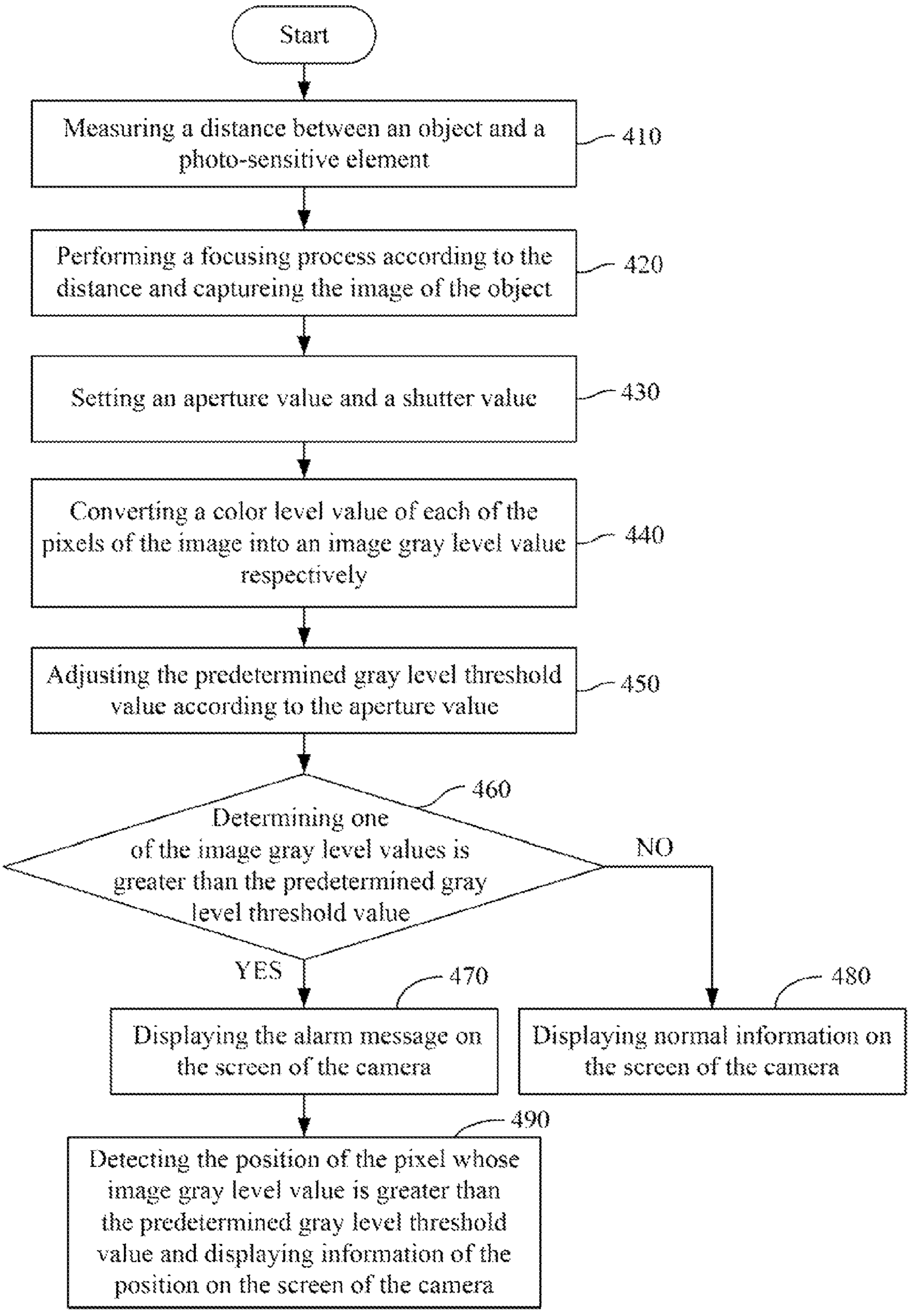
Start
Measuring a distance between an object and a photo-sensitive element
410
Performing a focusing process according to the distance and captureing the image of the object
420
Setting an aperture value and a shutter value
430
Converting a color level value of each of the pixels of the image into an image gray level value respectively
440
Adjusting the predetermined gray level threshold value according to the aperture value
450
460
Determining one of the image gray level values is greater than the predetermined gray level threshold value
NO
YES
470
Displaying the alarm message on the screen of the camera
480
Displaying normal information on the screen of the camera
490
Detecting the position of the pixel whose image gray level value is greater than the predetermined gray level threshold value and displaying information of the position on the screen of the camera

Fig. 4

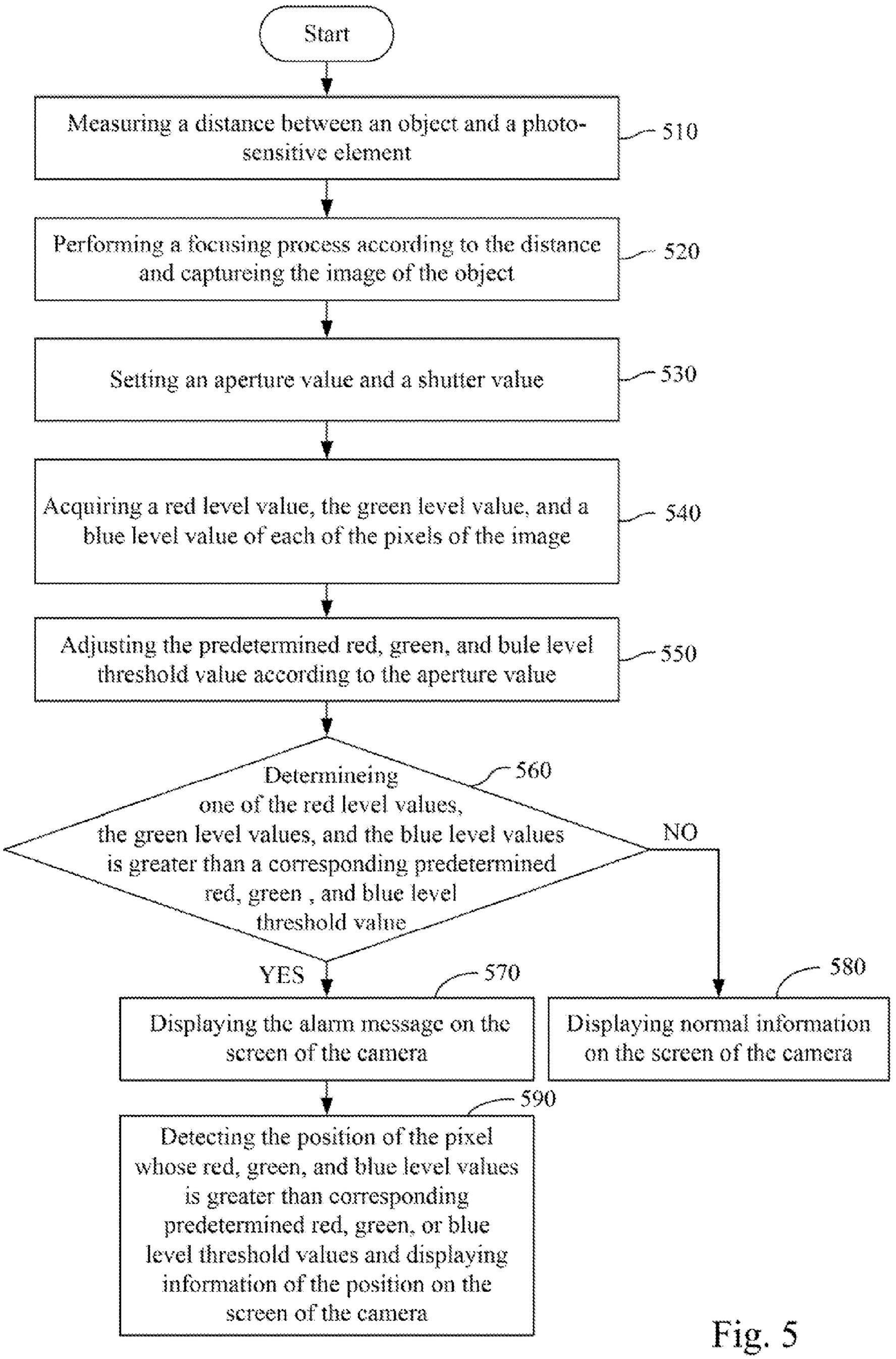
Start
Measuring a distance between an object and a photo-sensitive element
510
Performing a focusing process according to the distance and captureing the image of the object
520
Setting an aperture value and a shutter value
530
Acquiring a red level value, the green level value, and a blue level value of each of the pixels of the image
540
Adjusting the predetermined red, green, and bule level threshold value according to the aperture value
550
Determineing one of the red level values, the green level values, and the blue level values is greater than a corresponding predetermined red, green , and blue level threshold value
560
NO
YES
570
Displaying the alarm message on the screen of the camera
580
Displaying normal information on the screen of the camera
590
Detecting the position of the pixel whose red, green, and blue level values is greater than corresponding predetermined red, green, or blue level threshold values and displaying information of the position on the screen of the camera

Fig. 5

CAMERA WITH DUST CHECKING FUNCTION

RELATED APPLICATIONS

This application is a Continuation Application of U.S. application Ser. No. 13/592,991, filed on Aug. 23, 2012, which claims priority of Taiwanese Patent Application No. 101110392, filed on Mar. 26, 2012, the entirety of which is incorporated by reference herein.

BACKGROUND

1. Field of Disclosure

The embodiment of the present disclosure relates generally to a checking method and, more particularly, to a method for checking a camera and to a camera applying the method.

2. Description of Related Art

With the prevalence of digital single lens reflex cameras (DSLRs) in recent years, many optical manufacturers are producing a variety of lenses according to different requirements, such that users are able to adopt different kinds of lenses and thereby enjoy the benefit of capturing pictures with different focal lengths. However, the problem of dust entering the camera is increased with the changing of the lenses.

To remove the dust accumulated during changing of the lenses, there is a need to perform complex camera set-up processes manually in order to check for the presence of dust on a sensor of the camera. Such camera set-up processes are extremely complex, particularly for ordinary users.

In summary, the existing apparatus and techniques still have obvious defects and need further improvement. In order to solve the above problems, those skilled in the art are trying hard to find a solution, but no suitable method has been proposed.

SUMMARY

A method for checking a camera and a camera applying the method are provided. The method and camera address the problem of having to perform complex camera set-up processes manually when using a conventional camera in order to check for the presence of dust on a sensor of the camera.

Thus, one aspect of the embodiment of the present disclosure is to provide a camera. The camera includes a photo-sensitive element and a controller. The controller is electrically connected to the photo-sensitive element. The photo-sensitive element is configured to capture an image of an object. The controller is configured to convert a color level value of each of pixels of the image into an image gray level value, and the controller is configured to generate an alarm message to display on a screen of the camera when one of the image gray level values is higher than a predetermined gray level threshold value.

In another aspect of the embodiment of the present disclosure, a camera is provided. The camera includes a photo-sensitive element and a controller. The controller is electrically connected to the photo-sensitive element. The photo-sensitive element is configured to capture an image of an object. The controller is configured to acquire a green level value of each of a plurality of pixels of the image, and the controller is configured to generate an alarm message to display on a screen of the camera when one of the green level values is greater than a predetermined green level threshold value.

In summary, the embodiments of the present disclosure provide a method for checking a camera and a camera applying the method. The method and camera address the problem of having to perform complex camera set-up processes manually when using a conventional camera in order to check for the presence of dust on a sensor of the camera. Moreover, the method and the camera of the embodiments of the present disclosure enable accurate checking for the presence of dust on the sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure can be more fully understood by reading the following detailed description of the embodiment, with reference made to the accompanying drawings as follows:

FIG. **1** schematically shows a circuit block diagram of a camera according to embodiments of the present disclosure;

FIG. **2** schematically shows a diagram of a display frame of a camera screen according to embodiments of the present disclosure;

FIG. **3** schematically shows a flow diagram of a method for checking a camera according to embodiments of the present disclosure;

FIG. **4** schematically shows a flow diagram of a method for checking a camera according to embodiments of the present disclosure; and

FIG. **5** schematically shows a flow diagram of a method for checking a camera according to embodiments of the present disclosure.

DETAILED DESCRIPTION

The present disclosure is more particularly described in the following examples that are intended as illustrative only since numerous modifications and variations therein will be apparent to those skilled in the art. Various embodiments of the disclosure are now described in detail. Referring to the drawings, like numbers indicate like components throughout the views. As used in the description herein and throughout the claims that follow, the meaning of "a," "an," and "the" includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein and throughout the claims that follow, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.

The terms used in this specification generally have their ordinary meanings in the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. The use of examples anywhere in this specification, including examples of any terms discussed herein, is illustrative only, and in no way limits the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

As used herein, "around," "about" or "approximately" shall generally mean within 20 percent, preferably within 10 percent, and more preferably within 5 percent of a given value or range. Numerical quantities given herein are approximate, meaning that the term "around," "about" or "approximately" can be inferred if not expressly stated.

As used herein, the terms "comprising," "including," "having," "containing," "involving," and the like are to be understood to be open-ended, i.e., to mean including but not limited to.

FIG. **1** schematically shows a circuit block diagram of a camera **100** according to embodiments of the present disclo-

sure. As shown in the figure, in one aspect of the present disclosure, the camera **100** includes a photo-sensitive element **110**, an input/output interface **120**, a controller **130**, a screen **140**, a storing element **150**, an optical lens **160**, and a distance measuring module **170**. Furthermore, the controller **130** includes an aperture module **132**, a shutter module **134**, a focal length module **136**, and an ISO module **138**.

With respect to configuration, the photo-sensitive element **110**, the input/output interface **120**, the screen **140**, the storing element **150**, the optical lens **160**, and the distance measuring module **170** are all electrically connected to the controller **130**.

The problem of lost focus generated by capturing an image with the same color scheme (for example, white) can be solved through use of the distance measuring module **170** of the embodiment of the present disclosure to measure the distance between an object and the camera. Subsequently, the controller **130** is operable to control the optical lens **160** to perform a focusing process according to the distance, thereby solving the problem of lost focus.

In addition, the input/output interface **120** is operable to set the aperture value and the shutter value of the optical lens **160** respectively through the aperture module **132** and the shutter module **134** of the controller **130** such that the photo-sensitive element **110** is operable to capture the image of an object through the optical lens **160** according to the distance. In another embodiment of the present disclosure, the aperture module **132** of the controller **130** is operable to set the aperture value of the optical lens **160** by obtaining a predetermined aperture value from the storing element **150**, and the shutter module **134** of the controller **130** is operable to set the shutter value of the optical lens **160** by obtaining a predetermined shutter value from the storing element **150**, such that the photo-sensitive element **110** is operable to capture the image of the object through the optical lens **160** according to the distance. Hence, the camera **100** is operable to obtain a predetermined parameter value from the storing element **150** to adjust the optical lens **160** automatically so as to address the problem of having to perform complex camera set-up processes manually when using a conventional camera in order to check for the presence of dust on a sensor of the camera.

Moreover, the controller **130** is operable to convert the color level value of each of the pixels of the image into an image gray level value, and the controller **130** is also operable to determine whether one of the image gray level values is greater than a predetermined gray level threshold value. When one of the gray level values is greater than the predetermined gray level threshold value, the controller **130** is operable to generate an alarm message, and the screen **140** of the camera **100** is operable to display the alarm message.

In one embodiment, the input/output interface **120** is operable to adjust the predetermined gray level threshold value. In addition, the input/output interface **120** is further operable to set the aperture value and adjust the predetermined gray level threshold value according to the aperture value.

For example, it can be determined that there is dust on the photo-sensitive element **110** if one of the image gray level values is greater than the predetermined gray level threshold value. When this occurs, in order to warn a user to perform a clear process, an alarm message will be displayed on the screen **140** of the camera **100**. In addition, the gray level threshold value is adjusted according to aperture value due to the fact that there are different standards related to the problem of dust when adopting different apertures. Hence, the embodiment of the present disclosure can adaptively adjust standards related to the problem of dust according to different apertures such that the operation of the camera **100** of the embodiment of the present disclosure is more convenient.

In one embodiment, the controller **130** is further operable to detect a position of a pixel with an image gray level value that is greater than the predetermined gray level threshold value, and to display information of the position on the screen **140** of the camera **100**.

An example will now be provided with reference to FIG. **2** which schematically shows a diagram of a display frame of a camera screen according to embodiments of the present disclosure. In this exemplary embodiment, a division into nine squares is used. When the controller **130** detects that a position of a pixel with an image gray level value that is greater than the predetermined gray level threshold value is located on the upper left corner, the controller **130** will output a position signal according to the position. Subsequently, information of the position is displayed on the screen of the camera **100** as shown in FIG. **2**. Hence, a user can perform a dust-disposal process only with respect to the area of the photo-sensitive element **110** on which the dust is present such that the risk of contaminating the photo-sensitive element **110** can be reduced.

Compared with the previous aspect of the present disclosure, in another embodiment, the main difference is the operation mode of the camera **100**. First of all, in order to prevent the problem of lost focus, the embodiment of the present disclosure can employ the distance measuring module **170** to measure the distance between an object and the camera **100**. The controller **130** is then operable to control the optical lens **160** to perform a focusing process according to the distance.

In addition, the input/output interface **120** is operable to set the aperture value and the shutter value of the optical lens **160** respectively through the aperture module **132** and the shutter module **134** of the controller **130** such that the photo-sensitive element **110** is operable to capture the image of the object through the optical lens **160** according to the distance. In another embodiment of the present disclosure, the aperture module **132** of the controller **130** is operable to set the aperture value of the optical lens **160** by obtaining a predetermined aperture value from the storing element **150**, and the shutter module **134** of the controller **130** is operable to set the shutter value of the optical lens **160** by obtaining a predetermined shutter value from the storing element **150**, such that the photo-sensitive element **110** is operable to capture the image of the object through the optical lens **160** according to the distance. Hence, the camera **100** is operable to obtain a predetermined parameter value from the storing element **150** to adjust the optical lens **160** automatically so as to address the problem of having to perform complex camera set-up processes manually when using a conventional camera in order to check for the presence of dust on a sensor of the camera.

Moreover, the controller **130** is operable to acquire the green level value of each of the pixels of the image, and the controller **130** is also operable to determine whether one of the green level values is greater than a predetermined green level threshold value. When one of the green level values is greater than the predetermined green level threshold value, the controller **130** is operable to generate an alarm message, and the screen **140** of the camera **100** is operable to display the alarm message.

In one embodiment, the input/output interface **120** is operable to adjust the predetermined green level threshold value. In addition, the input/output interface **120** is further operable to set the aperture value and adjust the predetermined green level threshold value according to the aperture value.

For example, it can be determined that there is dust on the photo-sensitive element **110** if one of the green level values is greater than the predetermined green level threshold value. When this occurs, in order to warn a user to perform a clear process, an alarm message will be displayed on the screen **140** of the camera **100**. In addition, the green level threshold value is adjusted according to aperture value due to the fact that there are different standards related to the problem of dust when adopting different apertures. Hence, the embodiment of the present disclosure can adaptively adjust standards related to the problem of dust according to different apertures such that the operation of the camera **100** of the embodiment of the present disclosure is more convenient.

In one embodiment, controller **130** is further operable to detect a position of a pixel with a green level value that is greater than the predetermined green level threshold value, and to display information of the position on the screen of the camera. An example will now be provided with reference to FIG. **2** which schematically shows a diagram of a display frame of a camera screen according to embodiments of the present disclosure. In this exemplary embodiment, a division into nine squares is used. When controller **130** detects that a position of a pixel with a green level value that is greater than the predetermined green level threshold value is located on the upper left corner, the controller **130** will output a corresponding position signal according to the position. Subsequently, information of the position is displayed on the screen of the camera **100** as shown in FIG. **2**. Hence, a user can perform a dust-disposal process only with respect to the area of the photo-sensitive element **110** on which the dust is present such that the risk of contaminating the photo-sensitive element **110** can be reduced.

In still another embodiment, the controller **130** is further operable to acquire a red level value, the green level value, and a blue level value of each of the pixels of the image, and the controller **130** is operable to generate the alarm message to display on the screen **140** of the camera **100** when one of the red, green, and blue level values is greater than a corresponding predetermined red level threshold value, the corresponding predetermined green level threshold value, or a corresponding predetermined blue level threshold value.

FIG. **3** schematically shows a flow diagram of a method **300** for checking a camera according to embodiments of the present disclosure. As shown in the figure, the method for checking a camera **300** comprises the steps of capturing an image of an object using a photo-sensitive element (step **310**), converting the color level value of each of the pixels of the image into an image gray level value (step **330**), and displaying an alarm message on the screen of the camera when one of the image gray level values is higher than a predetermined gray level threshold value (step **350**). Hence, it can be determined that there is dust on a photo-sensitive element **110** if one of the image gray level values is greater than the predetermined gray level threshold value. When this occurs, in order to warn a user to perform a clear process, an alarm message will be displayed on the screen **140** of the camera **100**.

FIG. **4** schematically shows a flow diagram of a method **400** for checking a camera according to embodiments of the present disclosure.

Reference is now made to both FIG. **1** and FIG. **4**. In step **410**, a distance between an object and a photo-sensitive element is measured by the distance measuring module **170**. In step **420**, a focusing process is performed by the focal length module **136** of the controller **130** according to the distance and the image of the object is captured using the photo-sensitive element **110**. In step **430**, an aperture value and a shutter value are set by the aperture module **132** and the shutter module **134** of the controller **130** respectively. In another embodiment of the present disclosure, the aperture value and the shutter value of the optical lens **160** are set by obtaining a predetermined aperture value and a predetermined shutter value from the storing element **150** by the aperture module **132** and the shutter module **134** of the controller **130**. In step **440**, a color level value of each of the pixels of the image is converted into an image gray level value. In step **450**, the predetermined gray level threshold value is adjusted according to the aperture value. In step **460**, a determination is made as to whether one of the image gray level values is greater than the predetermined gray level threshold value, and in step **470**, the alarm message is displayed on the screen of the camera if one of the image gray level values is greater than the predetermined gray level threshold value. On the other hand, in step **480**, normal information is displayed on the screen of the camera if the image gray level values are all not greater than the predetermined gray level threshold value. After step **470**, a position of a pixel with an image gray level value that is greater than the predetermined gray level threshold value is detected, and information of the position is displayed on the screen of the camera in step **490**. Hence, a user can perform a dust-disposal process only with respect to the area of the photo-sensitive element **110** on which the dust is present such that the risk of contaminating the photo-sensitive element **110** can be reduced.

For example, it can be determined that there is dust on the photo-sensitive element **110** if one of the image gray level values is greater than the predetermined gray level threshold value. When this occurs, in order to warn a user to perform a clear process, an alarm message will be displayed on the screen **140** of the camera **100**. In addition, the gray level threshold value is adjusted according to aperture value due to the fact that there are different standards related to the problem of dust when adopting different apertures. Hence, the embodiment of the present disclosure can adaptively adjust standards related to the problem of dust according to different apertures such that the operation of the camera **100** is more convenient when the camera **100** employs the method **400** for checking the camera **100** of the embodiment of the present disclosure.

Compared with the method **300** for checking a camera as shown if FIG. **3**, the method **400** for checking a camera described with reference to FIG. **4** further comprises step **410** and step **420**. Referring to both FIG. **1** and FIG. **4**, the method **400** for checking a camera of the embodiment of FIG. **4** can solve the problem of lost focus generated by capturing an image with the same color scheme (for example, white) through the step of measuring the distance between the object and the camera by the distance measuring module **170** and performing the focusing process according to the distance in step **420**. The image of the object can be captured through the optical lens **160** of the photo-sensitive element **110**.

FIG. **5** schematically shows a flow diagram of a method **500** for checking a camera according to embodiments of the present disclosure. Reference is now made to both FIG. **1** and FIG. **5**. Due to the fact that the lost focus problem frequently occurs when capturing an image with the same color scheme (for example, white), the distance between an object and the camera can be measured by the distance measuring module **170** in step **510** of the embodiment of the present disclosure, and the focusing process can be performed according to the distance in step **520** to solve the problem of lost focus. The image of the object can be captured through the optical lens **160** of the photo-sensitive element **110**.

Referring to step **530**, an aperture value and a shutter value of the optical lens **160** are set by the aperture module **132** and the shutter module **134** of the controller **130** respectively. In another embodiment of the present disclosure, the aperture value and the shutter value of the optical lens **160** are set by obtaining a predetermined aperture value and a predetermined shutter value from the storing element **150** by the aperture module **132** and the shutter module **134** of the controller **130**. Hence, the method **500** for checking a camera of the embodiment of the present disclosure is performed to obtain a predetermined parameter value from the storing element **150** to adjust the optical lens **160** automatically so as to address the problem of having to perform complex camera set-up processes manually when using a conventional camera in order to check for the presence of dust on a sensor of the camera.

In step **540**, a red level value, a green level value, and a blue level value of each of the pixels of the image can be acquired by the controller **130**.

In step **550**, a predetermined red level threshold value, a predetermined green level threshold value, and a predetermined blue level threshold value can be adjusted according to the aperture by the input/output interface **120**. In step **560**, a determination is made by the controller **130** as to whether one of the red level values, the green level values, and the blue level values is greater than a corresponding predetermined red level threshold value, a corresponding predetermined green level threshold value, or a corresponding predetermined blue level threshold value. In addition, the predetermined red level threshold value, the predetermined green level threshold value, and the predetermined blue level threshold value can be adjusted according to the aperture value due to the fact that there are different standards related to the problem of dust when adopting different apertures. Hence, the embodiment of the present disclosure can adaptively adjust standards related to the problem of dust according to different apertures such that the operation of the camera **100** is more convenient when the camera **100** employs the method **500** for checking the camera **100** of the embodiment of the present disclosure.

As mentioned above, if one of the color level values is greater than the corresponding color level threshold value, the alarm message is displayed on the screen of the camera in step **570**. If all of the color level values are less than or equal to the corresponding color level threshold values, normal information is displayed on the screen of the camera in step **580**.

For example, it can be determined that there is dust on a photo-sensitive element **110** if one of the color level values is greater than the corresponding color level threshold value. When this occurs, in order to warn a user to perform a clear process, an alarm message will be displayed on the screen **140** of the camera **100**.

In step **590**, detection is performed with respect to a position of a pixel with one of a red level value, a green level value, and a blue level value that is greater than the corresponding predetermined red level threshold value, the corresponding predetermined green level threshold value, or the corresponding predetermined blue level threshold value, and information of the position is displayed on the screen of the camera. Hence, a user can perform a dust-disposal process only with respect to the area of the photo-sensitive element **110** on which the dust is present such that the risk of contaminating the photo-sensitive element **110** can be reduced.

Those having skill in the art will appreciate that the method **300**, **400**, **500** for checking a camera can be performed with software, hardware, and/or firmware. For example, if an implementer determines that speed and accuracy are paramount, the implementer may opt for a mainly hardware and/or firmware implementation; alternatively, if flexibility is paramount, the implementer may opt for a mainly software implementation; or, yet again alternatively, the implementer may opt for some combination of hardware, software, and/or firmware. Those skilled in the art will recognize that optical aspects of implementations will typically employ optically oriented hardware, software, and or firmware.

In addition, those skilled in the art will appreciate that each of the steps of the method **300**, **400**, **500** for checking a camera is named in accordance with the function performed in said step, and such naming is merely used to describe the technology in the embodiment of the present disclosure in detail, but the present disclosure is not limited in this regard. Therefore, combining the steps of said method into one step, dividing the steps into several steps, or rearranging the order of the steps is within the scope of the embodiment in the present disclosure.

In addition, the method **300**, **400**, **500** for checking a camera and a camera **100** applying the method of the embodiment of the present disclosure can adaptively adjust standards related to the problem of dust according to different apertures due to the fact that there are different standards related to the problem of dust when adopting different apertures. As a result, the operation of the camera **100** is more convenient.

It will be understood that the above description of embodiments is given by way of example only and that various modifications may be made by those with ordinary skill in the art. The above specification, examples and data provide a complete description of the structure and use of exemplary embodiments of the disclosure. Although various embodiments of the disclosure have been described above with a certain degree of particularity, or with reference to one or more individual embodiments, those with ordinary skill in the art could make numerous alterations to the disclosed embodiments without departing from the spirit or scope of this disclosure, and the scope thereof is determined by the claims that follow.

What is claimed is:

1. A camera, comprising:

a photo-sensitive element is configured to capture an image of an object;

a controller is electrically connected to the photo-sensitive element and is configured to convert a color level value of each of a plurality of pixels of the image into an image gray level value, wherein when one of the image gray level values is higher than a predetermined gray level threshold value, the controller is configured to generate an alarm message to display on a screen of the camera; and

an input/output interface is electrically connected to the controller, wherein the input/output interface is configured to adjust the predetermined gray level threshold value, and wherein the input/output interface is further configured to set an aperture value and adjust the predetermined gray level threshold value according to the aperture value.

2. The camera of claim **1**, wherein the controller is further configured to detect a position of one of the pixels in which the image gray level thereof is greater than the predetermined gray level threshold value, and display information of the position on the screen of the camera.

3. The camera of claim **1**, further comprising:

a distance measuring module is electrically connected to the controller and is configured to measure a distance between the object and the camera, wherein the control-

ler is configured to control an optical lens to perform a focusing process according to the distance.

4. A camera, comprising:

a photo-sensitive element is configured to capture an image of an object;

a controller is electrically connected to the photo-sensitive element and is configured to acquire a green level value of each of a plurality of pixels of the image, wherein when one of the green level values is higher than a predetermined green level threshold value, the controller is configured to generate an alarm message to display on a screen of the camera; and

an input/output interface is electrically connected to the controller, wherein the input/output interface is configured to adjust the predetermined green level threshold value, and the input/output interface is further configured to set an aperture value and adjust the predetermined green level threshold value according to the aperture value.

5. The camera of claim **4**, wherein the controller is further configured to detect a position of one of the pixels in which the green level value thereof is greater than the predetermined green level threshold value, and display information of the position on the screen of the camera.

6. The camera of claim **4**, wherein the controller is further configured to obtain a red level value, the green level value, and a blue level value of each of the pixels of the image, wherein when one of the red, green, and blue level values is greater than a corresponding predetermined red level threshold value, the corresponding predetermined green level threshold value, or a corresponding predetermined blue level threshold value, the controller is configured to generate an alarm message to display on the screen of the camera.

7. The camera of claim **4**, further comprising:

a distance measuring module is electrically connected to the controller and is configured to measure a distance between the object and the camera, wherein the controller is configured to control an optical lens to perform a focusing process according to the distance.

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