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Image capturing apparatus, control method therefor, and storage medium storing program

Abstract

An image capturing apparatus detects a specific object from a first image generated based on an image formed on the image sensor via a first optical system, generates, upon detection of the specific object from the first image, a plurality of first images based on images formed on the image sensor via the plurality of optical systems, and stores the plurality of first images. The image capturing apparatus detects, after detection of the specific object from the first image, the specific object from a second image generated based on an image formed on the image sensor via the second optical system, and generates, upon detection of the specific object from the second image, a plurality of second images based on images formed on the image sensor via the plurality of optical systems, and store the plurality of second images.

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Background/Summary

BACKGROUND OF THE DISCLOSURE
Field of the Disclosure
(1) The present disclosure relates to an image capturing apparatus suitably used for capturing a wide-range image, a control method for the image capturing apparatus, and a storage medium storing a program.
Description of the Related Art
(2) Image capturing apparatuses (e.g., an omnidirectional camera) configured to capture an image over a wider range than a human viewing angle have become widespread in recent years. The image is called an omnidirectional image. Posting images captured by such image capturing apparatuses to an unspecified number of people through social networking services and the like on the Internet has become a widespread practice.
(3) In the case of posting the images to an unspecified number of people, it is desirable to take measures for privacy protection to ensure that the images do not include information from which an individual can be identified. However, an image capturing apparatus configured to capture an omnidirectional image has almost no blind spot, so that a user ends up being included in the omnidirectional image. The issue occurs not only in an omnidirectional image, but also in a wide-range image.
(4) A system in which images on both sides are captured by a twin-lens 360-degree camera with a

time lag set using a timer, and these captured images are combined to form a 360-degree image is known. Thus, image capturing is performed twice with a time lag, and the user moves from a location in first image capturing to another location in second image capturing, which makes it possible to prevent the user from being captured in the 360-degree image. However, if the user has not moved sufficiently, or if the user has moved in an inappropriate direction, the 360-degree image in which the user is captured can be undesirably obtained.

(5) Japanese Patent Application Laid-Open No. 2020-16767 discusses an image capturing apparatus that performs control to obtain a first image so that a specific object is included in another field range different from a first field range, and performs control to obtain a second image so that the specific object is not included in the other field range, and combines the first image with the second image.

(6) International Publication No. 2018/025825 discusses an image capturing apparatus that captures a plurality of omnidirectional images including an object. The object moves during capturing of the plurality of images, which makes it possible to generate an image in which the object is removed in image combining processing.

(7) However, the image capturing apparatuses of the related art described above are configured to perform image capturing a number of times and simply combine images obtained with a time lag. Accordingly, if the user has not moved sufficiently, or if the user has moved in an inappropriate direction, an omnidirectional image in which the user is captured can be undesirably obtained.

SUMMARY OF THE DISCLOSURE

(8) The present disclosure has been made in view of the above-described circumstances and is directed to facilitating capturing a wide-range image in which a specific object, such as a user, is not captured.

(9) According to an aspect of the present disclosure, an image capturing apparatus comprising an image sensor, a plurality of optical systems configured to form an image of an object on the image sensor, the plurality of optical systems including at least a first optical system and a second optical system, light from the object present in different ranges entering the first optical system and the second optical system, a processor and a memory storing a program which, when executed by the processor, causes the image capturing apparatus to detect a specific object from a first image generated based on an image formed on the image sensor via the first optical system, generate, upon detection of the specific object from the first image, a plurality of first images based on images formed on the image sensor via the plurality of optical systems, and store the plurality of first images, detect, after detection of the specific object from the first image, the specific object from a second image generated based on an image formed on the image sensor via the second optical system, and generate, upon detection of the specific object from the second image, a plurality of second images based on images formed on the image sensor via the plurality of optical systems, and store the plurality of second images.

(10) Further features of the present disclosure will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIGS. **1**A, **1**B, and **1**C each illustrate a digital camera according to a first exemplary embodiment.

(2) FIG. **2** is a flowchart illustrating image capturing processing of capturing an omnidirectional image executed by the digital camera according to the first exemplary embodiment.

(3) FIG. **3** is a flowchart illustrating image capturing processing of capturing an omnidirectional image executed by a digital camera according to a second exemplary embodiment.

(4) FIG. **4** is a flowchart illustrating image capturing processing of capturing an omnidirectional image executed by a digital camera according to a third exemplary embodiment.
(5) FIG. **5** is a flowchart illustrating image capturing processing of capturing an omnidirectional image executed by a digital camera according to a fourth exemplary embodiment.
(6) FIGS. **6**A, **6**B, **6**C, and **6**D are flowcharts each illustrating details of image capturing operation trigger processing illustrated in FIG. **5**.

DESCRIPTION OF THE EMBODIMENTS

(7) Exemplary embodiments of the present disclosure will be described below with reference to the accompanying drawings.
(8) FIGS. **1**A to **1**C each illustrate a digital camera (hereinafter simply referred to as a camera) **100** as an image capturing apparatus according to a first exemplary embodiment. FIG. **1**A is a front perspective view of the camera **100**. FIG. **1**B is a rear perspective view of the camera **100**. The camera **100** is an omnidirectional camera that captures an omnidirectional image. Such a camera is also called a 360-degree camera, and an image captured by the camera is also referred to as a 360-degree image.
(9) The camera **100** includes two camera units A and B having different image capturing ranges. The camera unit A is a wide-angle camera having an image capturing range at the front of the camera **100** and having a wide image capturing range of 180 degrees or more upward, downward, leftward, and rightward at the front of the camera **100**. The camera unit B is a wide-angle camera having an image capturing range at the back of the camera **100** and having a wide image capturing range of 180 degrees or more upward, downward, leftward, and rightward at the back of the camera **100**.
(10) A front surface of the camera **100** is provided with a barrier **102***a* as a protective window that covers an image capturing system, including an imaging lens **103***a* (see FIG. **1**C) of the camera unit A, to prevent contamination or damage of the image capturing system. The barrier **102***a* may be an outer surface of the imaging lens **103***a*. A display unit **28** displays various kinds of information. A shutter button **61** is an operation unit for issuing an image capturing instruction. A light-emitting unit **21***a* is a light-emitting member, such as a light-emitting diode (LED), and informs a user of various states of the camera **100** with a light-emitting pattern or a light-emitting color.
(11) A back surface of the camera **100** is provided with a barrier **102***b* as a protective window that covers an image capturing system, including an imaging lens **103***b* (see FIG. **1**C) of the camera unit B, to prevent contamination or damage of the image capturing system. The barrier **102***b* may be an outer surface of the imaging lens **103***b*. Similar to the light-emitting unit **21***a*, a light-emitting unit **21***b* is a light-emitting member, such as an LED, and informs the user of various states of the camera **100** with a light-emitting pattern or a light-emitting color.
(12) A side surface of the camera **100** is provided with a mode selection switch **60** as an operation member for switching between various modes. An operation unit **70** is composed of operation members, such as various switches, buttons, dials, and touch sensors, to receive various operations from the user. A power switch **72** is a push button for switching between power-on and power-off. A connection interface (I/F) **25** is a connector to which a connection cable that connects the camera **100** and an external apparatus, such as a smartphone, a personal computer, or a television, is connected. A fixing portion **40** is, for example, a tripod screw hole. The fixing portion **40** is a portion that is to be fixed to a fixation device, such as a tripod.
(13) FIG. **1**C is a block diagram illustrating a configuration example of the camera **100**.
(14) The camera unit A includes the image capturing system including the imaging lens **103***a*, a shutter **101***a*, and an image capturing unit **22***a*. The imaging lens **103***a* is a wide-angle lens composed of a group of lenses including a zoom lens and a focus lens. Light from an object present in the image capturing range of the imaging lens **103***a* enters the imaging lens **103***a* and forms an image on the image capturing unit **22***a*. The shutter **101***a* has a diaphragm function that adjusts the amount of object light to be incident on the image capturing unit **22***a*. The image capturing unit **22***a*

includes an image sensor, such as a charge-coupled device (CCD) sensor or a complementary metal-oxide semiconductor (CMOS) sensor, that converts an optical image into an electric signal. An analog-to-digital (A/D) converter **23***a* converts an analog signal output from the image capturing unit **22***a* into a digital signal.

(15) The camera unit B includes the image capturing system including the imaging lens **103***b*, a shutter **101***b*, and an image capturing unit **22***b*. The imaging lens **103***b* is a wide-angle lens composed of a group of lenses including a zoom lens and a focus lens. Light from an object present in the image capturing range of the imaging lens **103***b* enters the imaging lens **103***b* and forms an image on the image capturing unit **22***b*. The shutter **101***b* has the diaphragm function that adjusts the amount of object light to be incident on the image capturing unit **22***b*. The image capturing unit **22***b* includes an image sensor, such as a CCD sensor or a CMOS sensor, that converts an optical image into an electric signal. An A/D converter **23***b* converts an analog signal output from the image capturing unit **22***b* into a digital signal.

(16) The image capturing units **22***a* and **22***b* each capture, for example, a virtual reality (VR) image. The VR image is an image that can be displayed in VR. Examples of the VR image include an omnidirectional image captured by an omnidirectional camera, and a panoramic image having a video range (effective video range) wider than a display range of an image that can be displayed on the display unit **28** at once. The VR image includes not only a still image, but also a moving image and a live view image (an image obtained in substantially real time from the camera **100**). The VR image has a video range (effective video range) covering a maximum of 360 degrees field of view in the up and down direction (vertical angle, zenith angle, elevation angle, depression angle, altitude angle) and in the left and right direction (horizontal angle, azimuth angle). The VR image needs not necessarily provide 360 degrees vertical coverage or 360 degrees horizontal coverage and also includes an image having a wider angle of view (field range) than that of an image that can be captured with a normal camera, or an image having a video range (effective video range) that is wider than the display range of an image that can be displayed on the display unit **28** at once. For example, an image captured with an omnidirectional camera configured to capture an image of an object in a field of view (angle of view) of 360 degrees in the left and right direction (horizontal angle, azimuth angle) and 210 degrees vertical angle from the zenith is a type of VR image. For example, another type of VR image is an image captured with a camera configured to capture an image of an object in a field of view (angle of view) of 180 degrees in the left and right direction (horizontal angle, azimuth angle) and 180 degrees vertical angle from the horizontal direction. In other words, an image having an image range covering a field of view of 160 degrees (±80 degrees) or more in both the up and down direction and the left and right direction and having a wider video range than a visible range of a human is a type of VR image. Displaying the VR image in VR (display mode: “VR view” display) while changing the orientation of a display apparatus in the left and right rotation direction enables the user to view an omnidirectional video image that is seamless in the left and right direction (horizontal rotation direction). In the up and down direction (vertical rotation direction), a seamless omnidirectional video image can be viewed in a range of ±105 degrees when viewed from the top (zenith). An area beyond 105 degrees from the top is a blank area where there is no video image. The VR image can also be referred to as an “image having a video range that forms at least a part of a virtual space (VR space)”.

(17) The VR display (VR view) is a display method (display mode) that displays a video image of a field range corresponding to the orientation of the display apparatus of the VR image, and the display range can be changed. In a case where the user wearing a head-mounted display (HMD) that is a display apparatus views the video image, the video image of the field range corresponding to the orientation of the face of the user is displayed. For example, a case is described where the video image being displayed at a certain point is a video image having a viewing angle (angle of view) of 0 degrees in the left and right direction (in a specific azimuth, e.g., north) and 90 degrees in the up and down direction (90 degrees from the zenith, i.e., horizontal direction), of the VR

image. In this state, if the display apparatus is turned upside down (e.g., the orientation of a display surface is changed such that the display surface faces north instead of south), the display range is changed to display a video image having a viewing angle with the center at 180 degrees in the left and right direction (opposite azimuth, e.g., south) and 90 degrees in the up and down direction (horizontal direction). In the case where the user wearing an HMD is viewing a video image, if the user turns his or her face to the south from the north (that is, looks back), the video image displayed on the HMD is also changed from a video image of a northern area to a video image of a southern area. The VR display makes it possible to provide the user with such a feeling as if the user were in the VR image (in the VR space). A smartphone mounted on a VR goggle (head-mounted adapter) is a type of HMD. The VR image display method is not limited to the above-described method. The display range may be moved (scrolled) based not only on a change in the orientation, but also on a user operation on a touch panel, a directional button, or the like. Further, during the VR display (VR view mode), the display range may be changed based on a change in the display range due to a change in the orientation, on a touch movement operation on a touch panel, or on a drag operation on an operation member, such as a mouse.

(18) An image processing unit **24** performs predetermined resizing processing, such as pixel interpolation or reduction, and color conversion processing on data supplied from the A/D converters **23***a* and **23***b* or data supplied from a memory control unit **15**. The image processing unit **24** also performs predetermined arithmetic processing using captured image data. A system control unit **50** performs exposure control and ranging control based on an arithmetic processing result obtained by the image processing unit **24**. Thus, through-the-lens (TTL) auto focus (AF) processing, automatic exposure (AE) processing, and flash preliminary emission (EF) processing are performed. In addition, the image processing unit **24** performs predetermined arithmetic processing using captured image data and performs TTL auto white balance (AWB) processing based on an obtained arithmetic processing result.

(19) Further, the image processing unit **24** performs basic image processing on images (fish-eye images) obtained from the A/D converters **23***a* and **23***b*, and then combines the images (image connection processing) to thereby generate a single VR image. In the image connection processing for connecting images to be combined, the image processing unit **24** calculates the amount of displacement between a reference image and a comparison image for each area by pattern matching processing for each of the images to be combined, to thereby detect a connection position. In consideration of the detected connection position and characteristics of each optical system lens, the image processing unit **24** corrects a distortion of each of the images to be combined by geometric transformation and converts the images into an omnidirectional image format. By blending the images of the omnidirectional image format to be combined, the image processing unit **24** finally generates a single VR image (omnidirectional image). The generated omnidirectional image is, for example, an image generated using equidistant cylindrical projection. The position of each pixel in the omnidirectional image can be associated with coordinates on the surface of a sphere.

(20) During VR display in live view or during playback, the image processing unit **24** performs image extraction processing for VR display of VR images, enlargement processing, distortion correction processing, or the like, and further performs rendering processing on a video random access memory (VRAM) of a memory **32**.

(21) Output data from the A/D converters **23***a* and **23***b* is written into the memory **32** via the image processing unit **24** and the memory control unit **15**, or via the memory control unit **15**. The memory **32** stores image data that is obtained by the image capturing units **22***a* and **22***b* and is converted into digital data by the A/D converters **23***a* and **23***b* and images to be output to an external display from the connection I/F **25**. The memory **32** has a sufficient storage capacity to store a predetermined number of still images as well as a moving image and audio up to a predetermined amount of time. The memory **32** also functions as an image display memory (video memory). Data

for image display stored in the memory **32** can be output to the external display from the connection I/F **25**. The VR images that are captured by the image capturing units **22***a* and **22***b*, generated by the image processing unit **24**, and accumulated in the memory **32** are sequentially transferred to and displayed on the external display. Thus, the external display functions as an electronic viewfinder and can provide a live view display (LV display). An image to be displayed in live view is hereinafter referred to as an LV image. The VR images accumulated in the memory **32** may be transferred to an external apparatus (e.g., smartphone) that is wirelessly connected via a communication unit **54** and displayed on the external apparatus to perform the LV display (remote LV display).

(22) A nonvolatile memory **56** is a memory used as an electrically erasable and recordable recording medium. For example, an electrically erasable programmable read-only memory (EEPROM) can be used. The nonvolatile memory **56** stores constants, programs, and the like for the operation of the system control unit **50**. The programs described herein refer to computer programs for executing various flowcharts to be described below in the present exemplary embodiment.

(23) The system control unit **50** is a control unit including at least one processor or circuit and controls the camera **100** as a whole. The system control unit **50** executes the programs recorded on the nonvolatile memory **56**, thereby implementing each processing according to the present exemplary embodiment described below. As a system memory **52**, a RAM, for example, is used. Constants and variables for the operation of the system control unit **50**, programs read from the nonvolatile memory **56**, and the like are loaded into the system memory **52**.

(24) Further, the system control unit **50** controls the memory **32**, the image processing unit **24**, and the memory control unit **15**, thereby performing display control processing.

(25) A system timer **53** is a time measurement unit that measures time used in various kinds of control processing and time of a built-in clock.

(26) The mode selection switch **60**, the shutter button **61**, and the operation unit **70** are operation members for inputting various operation instructions to the system control unit **50**.

(27) The mode selection switch **60** switches an operation mode of the system control unit **50** to any one of a still image recording mode, a moving image capturing mode, a playback mode, a communication connection mode, a user removal mode **1**, a user removal mode **2**, and the like. The still image recording mode includes an auto image capturing mode, an auto scene determination mode, a manual mode, an aperture priority mode (Av mode), a shutter speed priority mode (Tv mode), and a program AE mode. The still image recording mode also includes various scene modes in which image capturing settings are made for each image capturing scene, and a custom mode. The mode selection switch **60** enables the user to directly switch the operation mode to any one of these modes. Alternatively, after a screen is switched to an image capturing mode list screen once using the mode selection switch **60**, any one of the modes displayed on the display unit **28** may be selected, and the mode is switched using another operation member. Similarly, the moving image capturing mode may include a plurality of modes.

(28) A first shutter switch **62** is turned on halfway through an operation of the shutter button **61**, i.e., in a half-pressed state thereof (image capturing preparation instruction), and a first shutter switch signal SW**1** is generated. In response to the first shutter switch signal SW**1**, the system control unit **50** starts an image capturing preparation operation, such as AF processing, AE processing, AWB processing, or EF processing. A second shutter switch **64** is turned on when the operation of the shutter button **61** has completed, i.e., in a full-pressed state thereof (image capturing instruction), and a second shutter switch signal SW**2** is generated. In response to the second shutter switch signal SW**2**, the system control unit **50** starts a series of image capturing processing operations from reading of signals from the image capturing units **22***a* and **22***b* to writing of image data to a recording medium **150**. The shutter button **61** is not limited to a button that can be operated in two stages, i.e., full-pressing and half-pressing, but instead may be an

operation member that can be pressed only into one stage.
(29) In this case, the image capturing preparation operation and image capturing processing are continuously performed upon pressing of the shutter button **61** into one stage. The operation is identical to the operation in the case of full-pressing of the shutter button **61** that can be half-pressed and full-pressed (operation in a case where the shutter switch signals SW**1** and SW**2** are generated substantially simultaneously).
(30) The operation members of the operation unit **70** act as various function buttons to which functions are allocated as appropriate for each scene, for example, by an operation of selecting from various function icons and options displayed on the display unit **28**. Examples of the function buttons include an end button, a return button, an image feeding button, a jump button, a narrowing-down button, and an attribute change button. For example, when a menu button is pressed, a menu screen on which various settings can be made is displayed on the display unit **28**. The user can intuitively make various settings by operating the operation unit **70** while looking at the menu screen displayed on the display unit **28**.
(31) A power supply control unit **80** includes a battery detection circuit, a direct current (DC)-DC converter, and a switch circuit for switching blocks to be energized, and detects whether a battery is attached, the type of battery, and a remaining battery level. The power supply control unit **80** controls the DC-DC converter based on the detection result and an instruction from the system control unit **50** and supplies necessary voltage to the units including the recording medium **150** for a necessary period of time. A power supply unit **30** may be a primary battery, such as an alkaline battery or a lithium (Li) battery, a secondary battery, such as a Nickel-Cadmium (NiCd) battery, a nickel metal hydride (NiMH) battery, or a lithium-ion battery, or an alternating current (AC) adapter.
(32) A recording medium I/F **18** is an interface with the recording medium **150**, such as a memory card or a hard disk. The recording medium **150** is a recording medium, such as a memory card, for recording captured images, and includes a semiconductor memory, an optical disk, a magnetic disk, or the like. The recording medium **150** may be a replaceable recording medium that is attachable to and detachable from the camera **100** or may be a recording medium built in the camera **100**.
(33) The communication unit **54** is connected wirelessly or with a cable to transmit and receive video signals, audio signals, and the like. The communication unit **54** can also be connected to a wireless local area network (LAN) and the Internet. The communication unit **54** can transmit images (including LV images) captured by the image capturing units **22***a* and **22***b* and images recorded on the recording medium **150**, and can receive images and other various kinds of information from an external apparatus. Instead of being directly operated, the camera **100** can also be remotely operated using an external apparatus, such as a smartphone, that is wirelessly connected to the camera **100** via the communication unit **54** as a remote controller.
(34) An orientation detection unit **55** detects the orientation of the camera **100** relative to the direction of gravitational force. On the basis of the orientation detected by the orientation detection unit **55**, it is possible to determine whether images captured by the image capturing units **22***a* and **22***b* are images captured with the camera **100** held horizontally or images captured with the camera **100** held vertically. It is possible to determine an extent of tilting of the orientation in three axial directions of yaw, pitch, and roll when an image is captured. The system control unit **50** is configured to add orientation information corresponding to the orientation detected by the orientation detection unit **55** to an image file of each VR image captured by the image capturing units **22***a* and **22***b* and to rotate each image (adjust the orientation of each image to correct a tilt) and record the rotated image. As the orientation detection unit **55**, a combination of one or more of an acceleration sensor, a gyroscope sensor, a geomagnetic sensor, a direction sensor, an altitude sensor, and the like can be used. A motion (pan, tilt, lift, stationary or not, etc.) of the camera **100** can also be detected using an acceleration sensor, a gyroscope sensor, or an azimuth sensor that is the orientation detection unit **55**.

(35) A microphone **20** collects sound in the surrounding of the camera **100**, and the sound is recorded as audio of a moving image in VR images.
(36) The connection I/F **25** is a connection plug to which a high-definition multimedia interface (HDMI®) cable, a universal serial bus (USB) cable, or the like is connected to connect the camera **100** to an external apparatus to transmit and receive video images.
(37) Next, processing to be executed by the camera **100** according to the first exemplary embodiment will be described with reference to FIG. **2**. FIG. **2** is a flowchart illustrating omnidirectional image capturing processing executed by the camera **100**.
(38) In the first exemplary embodiment, when a predetermined object is detected by one of the two camera units A and B, the other of the camera units A and B performs first image capturing. After the first image capturing, when the predetermined object is detected by the other of the camera units A and B, the one of the camera units A and B performs second image capturing. After that, an image obtained in the first image capturing is combined with an image obtained in the second image capturing.
(39) The processing illustrated in the flowchart of FIG. **2** is implemented by the system control unit **50** loading a program recorded on the nonvolatile memory **56** into the system memory **52** and executing the program. When the camera **100** is powered on and a user removal mode is selected by operating the mode selection switch **60**, the processing in the flowchart of FIG. **2** is started. The user removal mode is a mode in which image capturing is performed twice to capture an omnidirectional image including no person. If the user removal mode is selected, the system control unit **50** may display, on the display unit **28**, information indicating start of image capturing to generate an omnidirectional image including no person or information indicating that the user needs to move to the opposite side after the first image capturing.
(40) If the image capturing instruction is received (shutter button **61** is pressed, or the image capturing instruction is issued by a remote operation) and an image capturing operation is carried out, in step S**201**, the system control unit **50** determines whether the user, which corresponds to the predetermined object, is detected by the camera unit A. The system control unit **50** detects the user from an image captured by the camera unit A by, for example, face recognition or person recognition. If the user is detected by the camera unit A (YES in step S**201**), the processing proceeds to step S**203**. If the user is not detected by the camera unit A (NO in step S**201**), the processing proceeds to step S**202**.
(41) In step S**203**, the system control unit **50** captures a first image (first image capturing) using the other camera unit B that is different from the camera unit A that has detected the user, and stores the captured image in the memory **32**.
(42) In step S**205**, the system control unit **50** waits until the user is detected by the camera unit B that has performed the first image capturing. If the user is detected by the camera unit B (YES in step S**205**), the processing proceeds to step S**207**.
(43) A state where the user is detected by the camera unit B indicates that the user has moved and is now outside of an image capturing range of the camera unit A.
(44) In step S**207**, the system control unit **50** captures a second image (second image capturing) using the camera unit A having the image capturing range in which the user is not present, and stores the captured image in the memory **32**.
(45) On the other hand, in step S**202**, the system control unit **50** determines whether the user is detected by the camera unit B. The system control unit **50** detects the user from an image captured by the camera unit B by, for example, face recognition or person recognition. If the user is detected by the camera unit B (YES in step S**202**), the processing proceeds to step S**204**. If the user is not detected by the camera unit B (NO in step S**202**), the processing returns to step S**201**.
(46) Steps S**204**, S**206**, and S**208** are similar to steps S**203**, S**205**, and S**207**, respectively, except that the camera unit A and the camera unit B are replaced with each other.
(47) Specifically, in step S**204**, the system control unit **50** uses the other camera unit A, which is

different from the camera unit B that has detected the user, to capture the first image (first image capturing), and stores the captured image in the memory **32**.
(48) In step S**206**, the system control unit **50** waits until the user is detected by the camera unit A that has performed the first image capturing. If the user is detected by the camera unit A (YES in step S**206**), the processing proceeds to step S**208**.
(49) A state where the user is detected by the camera unit A indicates that the user has moved and is now outside of an image capturing range of the camera unit B.
(50) In step S**208**, the system control unit **50** captures the second image (second image capturing) using the camera unit B having the image capturing range in which the user is not present, and stores the captured image in the memory **32**.
(51) In step S**209**, the system control unit **50** uses the image processing unit **24** to execute combining processing using the first image and the second image stored in the memory **32**, thereby generating an omnidirectional image. The system control unit **50** stores the omnidirectional image in the recording medium **150**, and then terminates the omnidirectional image capturing processing.
(52) As described above, image capturing is performed by switching between the camera units A and B to be used depending on the result of user detection. Thus, the first image capturing and the second image capturing are performed on condition that the user is not captured in the images. This makes it possible to capture the wide-range images in which the user is not captured by a simple procedure.
(53) If a time lag is set between the first image capturing and the second image capturing by a timer as in the related art, the user needs to move while checking the time. On the other hand, in the present exemplary embodiment, the first image capturing and the second image capturing are performed depending on the result of user detection, which eliminates the need for the user to check the time. In the case where a time lag is set between the first image capturing and the second image capturing by the timer, even if the user has smoothly moved after the first image capturing, the user needs to wait for a time set by the timer to elapse. On the other hand, in the present exemplary embodiment, the first image capturing and the second image capturing are performed depending on the result of user detection, which makes it possible to immediately perform the second image capturing if the user has smoothly moved after the first image capturing.
(54) Consequently, an omnidirectional image in which the user is not captured can be more reliably obtained.
(55) If the user is detected in steps S**201**, S**202**, S**205**, and S**206**, the light-emitting unit **21***a* or **21***b* in the camera unit that has detected the user may be turned on under the control of the system control unit **50**. This configuration makes it possible to inform the user of which of the camera units A and B has detected the user.
(56) When image capturing is performed in steps S**203**, S**204**, S**207**, and S**208**, the light-emitting unit **21***a* or **21***b* in the camera unit A or B that performs image capturing may be caused to blink, for example, under the control of the system control unit **50**. This configuration makes it possible to inform the user of which one of the camera units A and B performs the image capturing. After the image capturing, the light-emitting units **21***a* and **21***b* are turned off. Turning-on and blinking patterns during detection of the user and during image capturing, respectively, may be reversed.
(57) If the user is detected in steps S**201**, S**202**, S**205**, and S**206**, information indicating which one of the camera units A and B has detected the user may be displayed on the display unit **28** under the control of the system control unit **50** to thereby inform the user of the camera unit that has detected the user.
(58) When the image capturing is performed in steps S**203**, S**204**, S**207**, and S**208**, information indicating which one of the camera units A and B performs the image capturing may be displayed on the display unit **28** under the control of the system control unit **50** to thereby inform the user of the camera unit that performs the image capturing. In this case, information about the detection of the user and information about the image capturing may be sequentially displayed or may be

simultaneously displayed.
(59) While, in the present exemplary embodiment, the combining processing in step S**209** is executed by the camera **100**, the present exemplary embodiment is not limited thereto. For example, the first image and the second image may be transferred to an external apparatus, and the combining processing in step S**209** may be executed by the external apparatus.
(60) In the flowchart of FIG. **2**, the user is first detected by the camera unit A, and then is detected by the camera unit B. Alternatively, the user may be first detected by the camera unit B, and then may be detected by the camera unit A.
(61) Next, a second exemplary embodiment will be described. A configuration of a camera according to the second exemplary embodiment is similar to the configuration of the camera **100** according to the first exemplary embodiment. Hereinafter, components in the second exemplary embodiment that are similar to the components in the first exemplary embodiment are denoted by the same reference numerals, and the descriptions thereof are omitted. Differences between the second exemplary embodiment and the first exemplary embodiment will be mainly described.
(62) Processing to be executed by a camera **100** according to the second exemplary embodiment will be described with reference to FIG. **3**. FIG. **3** is a flowchart illustrating omnidirectional image capturing processing executed by the camera **100**.
(63) In the second exemplary embodiment, when a predetermined object is detected by one of the two camera units A and B, the other of the camera units A and B performs first image capturing. After the first image capturing, when the predetermined object is no longer detected by the one of the camera units A and B, the one of the camera units A and B performs second image capturing. After that, an image obtained in the first image capturing is combined with an image obtained in the second image capturing.
(64) The processing illustrated in the flowchart of FIG. **3** is implemented by the system control unit **50** loading a program recorded on the nonvolatile memory **56** into the system memory **52** and executing the program. When the camera **100** is powered on and a user removal mode is selected by operating the mode selection switch **60**, the processing in the flowchart of FIG. **3** is started.
(65) The processes of steps S**301** to S**304** and S**309** are respectively similar to the processes of steps S**201** to S**204** and S**209** in the first exemplary embodiment, and thus the descriptions thereof are omitted.
(66) In step S**305**, the system control unit **50** waits until the user is no longer detected by the camera unit A that has detected the user once. If the user is no longer detected by the camera unit A (NO in step S**305**), the processing proceeds to step S**307**. A state where the user is no longer detected by the camera unit A indicates that the user has moved and is now outside of the image capturing range of the camera unit A.
(67) In step S**307**, the system control unit **50** captures a second image (second image capturing) using the camera unit A having the image capturing range in which the user is not present, and stores the captured image in the memory **32**.
(68) On the other hand, in step S**306**, the system control unit **50** waits until the user is no longer detected by the camera unit B that has detected the user once. If the user is no longer detected by the camera unit B (NO in step S**306**), the processing proceeds to step S**308**. A state where the user is no longer detected by the camera unit B indicates that the user has moved and is now outside of the image capturing range of the camera unit B.
(69) In step S**308**, the system control unit **50** captures the second image (second image capturing) using the camera unit B having the image capturing range in which the user is not present, and stores the captured image in the memory **32**.
(70) As described above, as in the first exemplary embodiment, an omnidirectional image in which the user is not captured can be more reliably obtained.
(71) Further, for example, the user may be able to select a desired mode between the user removal mode described in the first exemplary embodiment, which is referred to as “user removal mode **1**”,

and the user removal mode described in the second exemplary embodiment, which is referred to as "user removal mode **2**".

(72) Next, a third exemplary embodiment will be described. A configuration of a camera according to the third exemplary embodiment is similar to the configuration of the camera **100** according to the first exemplary embodiment. Hereinafter, components in the third exemplary embodiment that are similar to the components in the first exemplary embodiment are denoted by the same reference numerals, and the descriptions thereof are omitted. Differences between the third exemplary embodiment and the first exemplary embodiment will be mainly described.

(73) Processing to be executed by a camera **100** according to the third exemplary embodiment will be described with reference to FIG. **4**. FIG. **4** is a flowchart illustrating omnidirectional image capturing processing executed by the camera **100**.

(74) In the third exemplary embodiment, when a predetermined object is detected by one of the two camera units A and B, first image capturing is performed by both of the camera units A and B. After the first image capturing, when the predetermined object is detected by the other of the camera units A and B, second image capturing is performed by both of the camera units A and B. After that, an image in which the predetermined object is not detected among images obtained in the first image capturing is combined with an image in which the predetermined object is not detected among images obtained in the second image capturing.

(75) The processing illustrated in the flowchart of FIG. **4** is implemented by the system control unit **50** loading a program recorded on the nonvolatile memory **56** into the system memory **52** and executing the program. When the camera **100** is powered on and a user removal mode is selected by operating the mode selection switch **60**, the processing in the flowchart of FIG. **4** is started.

(76) The processes of steps S**401**, S**402**, S**405**, and S**406** are respectively similar to the processes of steps S**201**, S**202**, S**205**, and S**206** in the first exemplary embodiment, and thus the descriptions thereof are omitted.

(77) In steps S**403** and S**404**, the system control unit **50** captures first images (first image capturing) using the camera unit A and the camera unit B, and stores the captured images in the memory **32**. Specifically, the image captured by the camera unit A and the image captured by the camera unit B are stored as the first images.

(78) In steps S**407** and S**408**, the system control unit **50** captures second images (second image capturing) using the camera unit A and the camera unit B, and stores the captured images in the memory **32**. Specifically, the image captured by the camera unit A and the image captured by the camera unit B are stored as the second images.

(79) In step S**409**, the system control unit **50** uses the image processing unit **24** to execute combining processing using an image in which the user is not detected of the first images stored in the memory **32** and an image in which the user is not detected of the second images stored in the memory **32**, thereby generating an omnidirectional image. The system control unit **50** stores the omnidirectional image in the recording medium **150**, and then terminates the omnidirectional image capturing processing. The images in which the user is not detected are selected in step S**409**. Alternatively, for example, the images in which the user is not detected may be selected in steps S**403**, S**404**, S**407**, and S**408**.

(80) In step S**409**, the system control unit **50** may perform recording control processing to store the captured images in the recording medium **150** by adding information based on which the image in which the user is not detected of the first images stored in the memory **32** and the image in which the user is not detected of the second images stored in the memory **32** are identifiable, instead of executing the combining processing using the image processing unit **24**. Then, an external apparatus may read the information from the recording medium **150**, and the combining processing may be executed using the image in which the user is not detected of the first images and the image in which the user is not detected of the second images.

(81) As described above, as in the first exemplary embodiment, an omnidirectional image in which

the user is not captured can be more reliably obtained.
(82) While, in the present exemplary embodiment, an example based on “user removal mode **1**” described in the first exemplary embodiment is described, the present exemplary embodiment is not limited thereto. Alternatively, the first image capturing and the second image capturing may be performed using the camera unit A and the camera unit B based on “user removal mode **2**” described in the second exemplary embodiment.
(83) Further, for example, the user may be able to select a desired mode among the user removal mode described in the first exemplary embodiment, which is referred to as “user removal mode **1**”, the user removal mode described in the second exemplary embodiment, which is referred to as “user removal mode **2**”, and the user removal mode described in the third exemplary embodiment, which is referred to as “user removal mode **3**”.
(84) Next, a fourth exemplary embodiment will be described. A configuration of a camera according to the fourth exemplary embodiment is similar to the configuration of the camera **100** according to the first exemplary embodiment. Hereinafter, components in the fourth exemplary embodiment that are similar to the components in the first exemplary embodiment are denoted by the same reference numerals, and the descriptions thereof are omitted. Differences between the fourth exemplary embodiment and the first exemplary embodiment will be mainly described.
(85) Processing to be executed by a camera **100** according to the fourth exemplary embodiment will be described with reference to FIGS. **5** and **6**A to **6**D. FIG. **5** is a flowchart illustrating omnidirectional image capturing processing executed by the camera **100**. FIGS. **6**A to **6**D are flowcharts each illustrating details of image capturing operation trigger processing illustrated in FIG. **5**.
(86) The fourth exemplary embodiment describes an example where second image capturing is performed on the condition that an image capturing instruction is received after first image capturing is performed.
(87) The processing illustrated in the flowchart of FIG. **5** is implemented by the system control unit **50** loading a program recorded on the nonvolatile memory **56** into the system memory **52** and executing the program. When the camera **100** is powered on and a user removal mode is selected by operating the mode selection switch **60**, the processing in the flowchart of FIG. **5** is started. In the present exemplary embodiment, the user can select either “user removal mode **1**” or “user removal mode **2**”.
(88) The processes of steps S**501** to S**504** and S**507** to S**509** are respectively similar to the processes of steps S**201** to step S**204** and S**207** to S**209** in the first exemplary embodiment, and thus the descriptions thereof are omitted.
(89) In step S**505**, the system control unit **50** executes image capturing operation trigger processing.
(90) If “user removal mode **1**” is selected, as illustrated in FIG. **6**A, in step S**505***a*, the system control unit **50** waits until the image capturing instruction is received. If the image capturing instruction is received (YES in step S**505***a*), the processing proceeds to step S**505***b*. In step S**505***b*, the system control unit **50** waits until the user is detected by the camera unit B that has performed the first image capturing. If the user is detected by the camera unit B (YES in step S**505***b*), the processing proceeds to step S**507**.
(91) If “user removal mode **2**” is selected, as illustrated in FIG. **6**C, in step S**505***c*, the system control unit **50** waits until the image capturing instruction is received. If the image capturing instruction is received (YES in step S**505***c*), the processing proceeds to step S**505***d*. In step S**505***d*, the system control unit **50** waits until the user is no longer detected by the camera unit A that has detected the user once. If the user is no longer detected by the camera unit A (NO in step S**505***d*), the processing proceeds to step S**507**.
(92) On the other hand, in step S**506**, the system control unit **50** executes the image capturing operation trigger processing.

(93) If "user removal mode **1**" is selected, as illustrated in FIG. **6**B, in step S**506***a*, the system control unit **50** waits until the image capturing instruction is received. If the image capturing instruction is received (YES in step S**506***a*), the processing proceeds to step S**506***b*. In step S**506***b*, the system control unit **50** waits until the user is detected by the camera unit A that has performed the first image capturing. If the user is detected by the camera unit A (YES in step S**506***b*), the processing proceeds to step S**508**.
(94) If "user removal mode **2**" is selected, as illustrated in FIG. **6**D, in step S**506***c*, the system control unit **50** waits until the image capturing instruction is received. If the image capturing instruction is received (YES in step S**506***c*), the processing proceeds to step S**506***d*. In step S**506***d*, the system control unit **50** waits until the user is no longer detected by the camera unit B that has detected the user once. If the user is no longer detected by the camera unit B (NO in step S**506***d*), the processing proceeds to step S**508**.
(95) As described above, as in the first exemplary embodiment, an omnidirectional image in which the user is not captured can be more reliably obtained.
(96) While, in the present exemplary embodiment, an example where an omnidirectional image is captured is described, the present exemplary embodiment is not limited thereto. The present disclosure can be applied to capturing of a wide-range image.
(97) Various kinds of control processing described as being executed by the system control unit **50** in the above-described exemplary embodiments may be executed by one piece of hardware or by a plurality of pieces of hardware (e.g., a plurality of processors or circuits) sharing the processing to control the entire apparatus.
(98) While, in the above-described exemplary embodiments, the digital camera **100** is described as the image capturing apparatus to which the present disclosure is applied, the image capturing apparatus is not limited thereto. The present disclosure can also be applied to any electronic apparatus, such as a smartphone, as long as the electronic apparatus functions as an image capturing apparatus including two camera units having different image capturing ranges.
(99) The above-described exemplary embodiments illustrate an example in which the camera **100** functions as a control apparatus for the image capturing apparatus to which the present disclosure is applied. Alternatively, for example, the control apparatus for the image capturing apparatus to which the present disclosure is applied may be configured as an apparatus different from the image capturing apparatus, such as the camera **100**.
(100) The exemplary embodiments of the present disclosure have been described above. The above-described exemplary embodiments, however, are merely specific examples for carrying out the present disclosure, and the technical scope of the present disclosure should not be interpreted in a limited way. In other words, the present disclosure can be carried out in various forms without departing from the technical idea or the main features thereof.
(101) According to the exemplary embodiments of the present disclosure, a wide-range image in which a predetermined object, such as a user, is not captured can be more reliably obtained.
Other Embodiments
(102) Embodiment(s) of the present disclosure can also be realized by a computer of a system or apparatus that reads out and executes computer executable instructions (e.g., one or more programs) recorded on a storage medium (which may also be referred to more fully as a 'non-transitory computer-readable storage medium') to perform the functions of one or more of the above-described embodiment(s) and/or that includes one or more circuits (e.g., application specific integrated circuit (ASIC)) for performing the functions of one or more of the above-described embodiment(s), and by a method performed by the computer of the system or apparatus by, for example, reading out and executing the computer executable instructions from the storage medium to perform the functions of one or more of the above-described embodiment(s) and/or controlling the one or more circuits to perform the functions of one or more of the above-described embodiment(s). The computer may comprise one or more processors (e.g., central processing unit

(CPU), micro processing unit (MPU)) and may include a network of separate computers or separate processors to read out and execute the computer executable instructions. The computer executable instructions may be provided to the computer, for example, from a network or the storage medium. The storage medium may include, for example, one or more of a hard disk, a random-access memory (RAM), a read only memory (ROM), a storage of distributed computing systems, an optical disk (such as a compact disc (CD), digital versatile disc (DVD), or Blu-ray Disc (BD)™), a flash memory device, a memory card, and the like.
(103) While the present disclosure has been described with reference to exemplary embodiments, it is to be understood that the present disclosure is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.
(104) This application claims the benefit of Japanese Patent Application No. 2022-198461, filed Dec. 13, 2022, which is hereby incorporated by reference herein in its entirety.

Claims

1. An image capturing apparatus comprising: an image sensor; a plurality of optical systems configured to form an image of an object on the image sensor, the plurality of optical systems including at least a first optical system and a second optical system, light reflected from the object present in different spatial ranges entering the first optical system and the second optical system; a processor; and a memory storing a program which, when executed by the processor, causes the image capturing apparatus to: detect a specific object from a first image generated based on an image formed on the image sensor via the first optical system; generate, upon detection of the specific object from the first image, a plurality of first images based on images formed on the image sensor via the first optical system and the second optical system, and store the plurality of first images; detect, after detection of the specific object from the first image, the specific object from a second image generated based on an image formed on the image sensor via the second optical system; generate, upon detection of the specific object from the second image, a plurality of second images based on images formed on the image sensor via the plurality of optical systems, and store the plurality of second images; and combine an image of the plurality of first images in which the specific object is not detected with an image in the plurality of second images in which the specific object is not detected, wherein the image of the plurality of first images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the first optical system, and the image of the plurality of second images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the second optical system.
2. The image capturing apparatus according to claim 1, wherein the image of the plurality of first images in which the specific object is not detected is an image generated based on the image formed on the image sensor via the second optical system, and the image of the plurality of second images in which the specific object is not detected is an image generated based on the image formed on the image sensor via the first optical system.
3. The image capturing apparatus according to claim 1, wherein the program when executed by the processor causes the image capturing apparatus to perform control to store the plurality of first images and the plurality of second images in a recording medium after adding information indicating the specific object has not been detected based on which the image of the plurality of second images in which the specific object is not detected and the image of the plurality of first images in which the specific object is not detected are identified.
4. The image capturing apparatus according to claim 1, wherein the program when executed by the processor causes the image capturing apparatus to select any one of a plurality of operation modes according to a user operation, and wherein, in a case where a predetermined operation mode is

selected, the plurality of first images and the plurality of second images are generated and stored.

5. The image capturing apparatus according to claim 1, wherein the program when executed by the processor causes the image capturing apparatus to receive an image capturing instruction according to a user operation, and wherein, upon reception of the image capturing instruction, processing for detecting the specific object from the first image is executed.

6. An image capturing apparatus comprising: an image sensor; a plurality of optical systems configured to form an image of an object on the image sensor, the plurality of optical systems including at least a first optical system and a second optical system, light reflected from the object present in different spatial ranges entering the first optical system and the second optical system; a processor; and a memory storing a program which, when executed by the processor, causes the image capturing apparatus to: detect a specific object from a first image generated based on an image formed on the image sensor via the first optical system; generate, upon detection of the specific object from the second image, a plurality of second images based on an image formed on the image sensor via the first optical system and the second optical system, and store the plurality of second images; and issue a notification as to whether the specific object that is detected from the first image or the second image is identifiable.

7. The image capturing apparatus according to claim 6, wherein the program when executed by the processor causes the image capturing apparatus to issue the notification using a notification unit of an optical system corresponding to one of the first image and the second image from which the specific object is detected.

8. The image capturing apparatus according to claim 6, wherein the program when executed by the processor causes the image capturing apparatus to combine an image of the plurality of first images in which the specific object is not detected with an image of the plurality of second images in which the specific object is not detected.

9. The image capturing apparatus according to claim 8, wherein the image of the plurality of first images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the first optical system, and the image of the plurality of second images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the second optical system.

10. The image capturing apparatus according to claim 6, wherein the image of the plurality of first images in which the specific object is not detected is an image generated based on the image formed on the image sensor via the second optical system, and the image of the plurality of second images in which the specific object is not detected is an image generated based on the image formed on the image sensor via the first optical system.

11. The image capturing apparatus according to claim 6, wherein the program when executed by the processor causes the image capturing apparatus to perform control to store the plurality of first images and the plurality of second images in a recording medium after adding information based on which the image of the plurality of second images in which the specific object is not detected and the image of the plurality of first images in which the specific object is not detected are identified.

12. The image capturing apparatus according to claim 6, wherein the program when executed by the processor causes the image capturing apparatus to select any one of a plurality of operation modes according to a user operation, and wherein, in a case where a predetermined operation mode is selected, the plurality of first images and the plurality of second images are generated and stored.

13. The image capturing apparatus according to claim 6, wherein the program when executed by the processor causes the image capturing apparatus to receive an image capturing instruction according to a user operation, and wherein, upon reception of the image capturing instruction, processing for detecting the specific object from the first image is executed.

14. A control method for an image capturing apparatus including an image sensor and a plurality of optical systems configured to form an image of an object on the image sensor, the plurality of

optical systems including at least a first optical system and a second optical system, light reflected from the object present in different spatial ranges entering the first optical system and the second optical system, the control method comprising: detecting a specific object from a first image generated based on an image formed on the image sensor via the first optical system; generating, upon detection of the specific object from the first image, a plurality of first images based on images formed on the image sensor via the first optical system and the second optical system, and storing the plurality of first images; detecting, after detection of the specific object from the first image, the specific object from a second image generated based on an image formed on the image sensor via the second optical system; generating, upon detection of the specific object from the second image, a plurality of second images based on images formed on the image sensor via the plurality of optical systems, and storing the plurality of second images; and combining an image of the plurality of first images in which the specific object is not detected with an image of the plurality of second images in which the specific object is not detected, wherein the image of the plurality of first images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the first optical system, and the image of the plurality of second images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the second optical system.

15. A non-transitory computer-readable storage medium storing a program for causing a computer to execute a control method for an image capturing apparatus including an image sensor and a plurality of optical systems configured to form an image of an object on the image sensor, the plurality of optical systems including at least a first optical system and a second optical system, light reflected from the object present in different spatial ranges entering the first optical system and the second optical system, the control method comprising: detecting a specific object from a first image generated based on an image formed on the image sensor via the first optical system; generating, upon detection of the specific object from the first image, a plurality of first images based on images formed on the image sensor via the first optical system and the second optical system, and storing the plurality of first images; detecting, after detection of the specific object from the first image, the specific object from a second image generated based on an image formed on the image sensor via the second optical system; generating, upon detection of the specific object from the second image, a plurality of second images based on images formed on the image sensor via the plurality of optical systems, and storing the plurality of second images; and combining an image of the plurality of first images in which the specific object is not detected with an image of the plurality of second images in which the specific object is not detected, wherein the image of the plurality of first images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the first optical system, and the image of the plurality of second images in which the specific object is not detected is an image other than the image generated based on the image formed on the image sensor via the second optical system.

16. A control method for an image capturing apparatus including an image sensor and a plurality of optical systems configured to form an image of an object on the image sensor, the plurality of optical systems including at least a first optical system and a second optical system, light reflected from the object present in different spatial ranges entering the first optical system and the second optical system, the control method comprising: detecting a specific object from a first image generated based on an image formed on the image sensor via the first optical system; generating, upon detection of the specific object from the first image, a plurality of first images based on images formed on the image sensor via the first optical system and the second optical system, and storing the plurality of first images; detecting, after detection of the specific object from the first image, the specific object from a second image generated based on an image formed on the image sensor via the second optical system; generating, upon detection of the specific object from the

second image, a plurality of second images based on images formed on the image sensor via the plurality of optical systems, and storing the plurality of second images; and issuing a notification as to whether the specific object that is detected from the first image or the second image is identifiable.

17. A non-transitory computer-readable storage medium storing a program for causing a computer to execute a control method for an image capturing apparatus including an image sensor and a plurality of optical systems configured to form an image of an object on the image sensor, the plurality of optical systems including at least a first optical system and a second optical system, light reflected from the object present in different spatial ranges entering the first optical system and the second optical system, the control method comprising: detecting a specific object from a first image generated based on an image formed on the image sensor via the first optical system; generating, upon detection of the specific object from the first image, a plurality of first images based on images formed on the image sensor via the first optical system and the second optical system, and storing the plurality of first images; detecting, after detection of the specific object from the first image, the specific object from a second image generated based on an image formed on the image sensor via the second optical system; generating, upon detection of the specific object from the second image, a plurality of second images based on images formed on the image sensor via the plurality of optical systems, and storing the plurality of second images; and issuing a notification as to whether the specific object that is detected from the first image or the second image is identifiable.