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| United States Patent | 12389108 |
| Kind Code | B2 |
| Date of Patent | August 12, 2025 |
| Inventor(s) | Okuwaki; Maiki et al. |


# Electronic equipment, method for controlling the same, and recording medium


## Abstract

Electronic equipment includes an obtaining unit configured to obtain a third image in which a first image captured via a first optical system and a second image captured via a second optical system are arranged side by side, the second image having parallax with the first image and a setting unit configured to set, in the third image, a target area to which predetermined processing is to be applied, based on a user operation. The setting unit is configured to set the target area in such a manner that the item indicating the target area includes either one of the first image and the second image.



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**Appl. No.:** **18/420106**

**Filed:** **January 23, 2024**

## Prior Publication Data

| Document Identifier | Publication Date |
|---|---|
| US 20240205534 A1 | Jun. 20, 2024 |

## Foreign Application Priority Data

| | | |
|---|---|---|
| JP | 2021-091344 | May. 31, 2021 |

## Related U.S. Application Data

continuation parent-doc US 17824361 20220525 US 11949977 child-doc US 18420106

## Publication Classification

**Int. Cl.:** **H04N23/60** (20230101); **H04N13/207** (20180101); **H04N23/63** (20230101); **H04N23/69** (20230101); H04N23/698 (20230101)

**U.S. Cl.:**

CPC **H04N23/632** (20230101); **H04N13/207** (20180501); **H04N23/635** (20230101); **H04N23/69** (20230101); H04N23/698 (20230101)

## Field of Classification Search

**CPC:** H04N (13/207); H04N (13/218); H04N (13/296); H04N (23/60); H04N (23/62); H04N (23/631); H04N (23/632); H04N (23/635); H04N (23/69); H04N (23/698)

**USPC:** 348/49

## References Cited


**U.S. PATENT DOCUMENTS**

| Patent No. | Issued Date | Patentee Name | U.S. Cl. | CPC |
|---|---|---|---|---|
| 11949977 | 12/2023 | Okuwaki | N/A | H04N 23/62 |
| 2012/0026300 | 12/2011 | Kakiuchi | 348/E13.074 | H04N 13/218 |
| 2018/0106986 | 12/2017 | Xu | N/A | G02B 7/021 |
| 2022/0385828 | 12/2021 | Okuwaki | N/A | H04N 23/635 |
| 2024/0236503 | 12/2023 | Shoji | N/A | H04N 23/634 |

**FOREIGN PATENT DOCUMENTS**

| Patent No. | Application Date | Country | CPC |
|---|---|---|---|
| 1534991 | 12/2003 | CN | N/A |
| 103842907 | 12/2013 | CN | N/A |
| 105282534 | 12/2015 | CN | N/A |
| 2001320733 | 12/2000 | JP | N/A |
| 2006013609 | 12/2005 | JP | N/A |
| 2010103949 | 12/2009 | JP | N/A |
| 2010177921 | 12/2009 | JP | N/A |
| 2020039135 | 12/2019 | JP | N/A |
| 2013046886 | 12/2012 | WO | N/A |



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## Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) The present application is a continuation of U.S. patent application Ser. No. 17/824,361, filed on May 25, 2022, which claims priority from Japanese Patent Application No. 2021-091344 filed May 31, 2021, which are hereby incorporated by reference herein in their entireties.

## BACKGROUND OF THE INVENTION

### Field of the Invention

(1) The present invention relates to electronic equipment, a method for controlling the same, and a recording medium.

### Description of the Related Art

(2) Digital cameras having two lens optical systems have been known in recent years. With a digital camera having two lens optical systems disposed to capture images in the same direction, a 180-degree angle image (hemispherical image) or a stereoscopic view image can be generated from two images, having parallax, obtained by the respective optical systems. With a digital camera having two optical systems disposed to capture images in opposite directions, a 360-degree angle image (spherical image) can be generated from two images obtained by the respective optical systems.

(3) In image capturing of two images having parallax by using such a digital camera including two optical systems, the user observes two live view images during the image capturing. With a normal digital camera having one optical system, the user enlarge one live view image and display the one enlarged image for detailed observation.

(4) Japanese Patent Application Laid-Open No. 2013-201527 discusses a digital camera, having one optical system, capable of separately setting a position of a zoom frame and a position of an automatic focus (AF) frame within a live view image. In a case where a user issues a zoom instruction, the live view image is enlarged at the position where the zoom frame is displayed on the live view image. Japanese Patent Application Laid-Open No. 2019-12881 discusses displaying a spherical image obtained via two optical systems, and in response to an imaging preparation instruction from the user, enlarging a live view image in a specific zoom target area and displaying the enlarged image.

(5) However, Japanese Patent Application Laid-Open No. 2013-201527 does not include a detailed discussion of a case of displaying two live view images, and consequently there is not a detailed discussion on which of the live view images displays the zoom frame and which of the live view images is enlarged. According to Japanese Patent Application Laid-Open No. 2019-12881, the zoom target area, i.e., which part of a fisheye image is to be enlarged is unknown until the user issues the imaging preparation instruction.

(6) The present invention is directed to enabling the user to visually observe a zoom target position in a state where a plurality of live view images obtained via a plurality of optical systems is displayed.

## SUMMARY OF THE INVENTION

(7) According to an aspect of the present invention, electronic equipment includes an obtaining unit configured to obtain a third image in which a first image captured via a first optical system and a second image captured via a second optical system are arranged side by side, the second image having parallax with the first image, a setting unit configured to set, in the third image, a target area to which predetermined processing is to be applied, based on a user operation, a first receiving unit configured to receive a position designation for a position of an item indicating the target area, a second receiving unit configured to receive a zoom instruction for enlarging the target area, and a display control unit configured to display the third image and the item on a display unit, wherein the setting unit is configured to set the target area in such a manner that the item indicating the target area includes either one of the first image and the second image, change, in response to the position designation performed by a user, a position of the item to a designated position, and

control, in a case where the zoom instruction is issued by the user, enlarging of the third image based on the target area indicated by the item.
(8) Further features of the present invention 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 and **1**B are external views illustrating a digital camera.
(2) FIG. **2** is a schematic block diagram illustrating a hardware configuration example of the digital camera.
(3) FIG. **3** is a schematic diagram illustrating an example of a configuration of a lens unit.
(4) FIG. **4** is a flowchart illustrating display mode change processing by the digital camera and processing when a touch-down operation is performed during a live view according to an exemplary embodiment.
(5) FIGS. **5**A to **5**F are diagrams illustrating examples of a live view display on the digital camera on which a dual-lens unit is attached, according to the present exemplary embodiment.
(6) FIGS. **6**A and **6**B are a flowchart illustrating zoom frame moving processing by the digital camera according to the present exemplary embodiment.
(7) FIGS. **7**A and **7**B are diagrams illustrating a border between left and right live view images on the digital camera on which the dual-lens unit is attached, according to the present exemplary embodiment.
(8) FIGS. **8**A and **8**B are a flowchart illustrating zoom processing and imaging operations by the digital camera according to the exemplary embodiment.
(9) FIGS. **9**A to **9**F are diagrams illustrating zoom operations by the digital camera on which the dual-lens unit is attached, according to the exemplary embodiment.
DESCRIPTION OF THE EMBODIMENTS
(10) Exemplary embodiments of the present invention will be described below with reference to the drawings. An exemplary embodiment will initially be described by using a case where the electronic equipment is a digital camera (imaging apparatus) as an example.
(11) A digital camera **100** according to the present exemplary embodiment can capture a dual-lens image and display the dual-lens image on a display unit. The dual-lens image is an image having a left image and a right image arranged side by side and having lateral parallax between the left image and the right image. The digital camera **100** can apply predetermined image processing to a target area of the image displayed on the display unit. An example of the predetermined image processing is zoom processing. In the following description, a case of the zoom processing will be described in detail. The digital camera **100** displays an enlarged image, which is obtained by enlarging the target area in response to a zoom instruction, on the display unit. The predetermined image processing is not limited to the zoom processing. Examples of the predetermined image processing may include processing for detecting a luminance distribution or chromaticity distribution in the target area and generating a histogram or a waveform monitor, and processing for applying filter processing, such as contrast enhancement processing to the target area. In the present exemplary embodiment, the zoom instruction is issued by a pressing operation performed on a zoom button **78** serving as a physical member that can be pressed down. However, the zoom instruction may be issued by a pinch-out operation performed on a touch panel **70***a*. An enlarged display may be cancelled by a pinch-in operation.
(12) The digital camera **100** according to the present exemplary embodiment adapts an item indicating the target area to a dual-lens image to display the item on the dual-lens image. Examples of the item include a frame-shape indicator indicating the target area and a semitransparent color

image superimposed on the target area. The digital camera **100** can change a display position of the item (i.e., the target area indicated by the item) based on user operations. In a case where a dual-lens image is displayed, the digital camera **100** displays the item at a position where the target area of the item does not extend over both the left and right images. That is, the target area is determined to not include both the left and right images. In other words, the target area is set to include one of the left and right images.

(13) The digital camera **100** controls display of the item in such a manner that the target area indicated by the item does not extend over both the left and right images even if a user operation to change the display position of the item (position of the target area) is performed.

(14) FIGS. **1**A and **1**B illustrate external views of the digital camera **100** that is an example of an apparatus to which the present exemplary embodiment can be applied. FIG. **1**A is a front perspective view of the digital camera **100**. FIG. **1**B is a rear perspective view of the digital camera **100**. As illustrated in FIG. **1**B, a display unit **28** for displaying images and various types of information is disposed at the rear of the digital camera **100**. A touch panel **70***a* is a touch detection unit that can detect a touch operation performed on the display surface (operation surface) of the display unit **28**. An external-viewfinder display unit **43** is a display unit disposed on the top of the digital camera **100**. The external-viewfinder display unit **43** displays various setting values of the digital camera **100**, including a shutter speed and an aperture value. The display unit **28** may be built into the digital camera **100** or detachably attached to the digital camera **100**. Also, the display unit **28** may be an external device connected to a communication unit **54** of the digital camera **100**.

(15) A shutter button **61** is an operation unit for receiving an imaging instruction. A mode change switch **60** is an operation unit for switching various modes. Terminal covers **40** are covers that protect connection cable connectors (not illustrated) for connecting connection cables of external devices with the digital camera **100**. A main electronic dial **71** included in an operation unit **70** is a rotary operation member. Setting values, such as the shutter speed and the aperture value, can be changed by rotating the main electronic dial **71**. A power switch **72** is an operation member for powering the digital camera **100** on and off.

(16) A sub electronic dial **73** included in the operation unit **70** is a rotary operation member for moving a selection frame and scrolling images. A directional pad **74** included in the operation unit **70** is a directional pad (four-way directional pad) capable of being pressed up, down, left, and right portions individually. The digital camera **100** can perform operations based on the pressed portion of the directional pad **74**. A set button **75** included in the operation unit **70** is a push button for mainly receiving confirmation of a selected item. A moving image button **76** is a button for receiving instructions to start and stop moving image capturing (recording).

(17) The zoom button **78** included in the operation unit **70** is an operation button for turning on and off a zoom mode during a live view display in an imaging mode. In a case where the zoom mode is on, a live view (LV) image can be zoomed in and out by an operation performed on the main electronic dial **71**. In a playback mode, the zoom button **78** functions as a zoom button for zooming in a reproduced image and increasing the zoom ratio. A playback button **79** included in the operation unit **70** is an operation button for switching between the imaging mode and the playback mode. In a case where the playback button **79** is pressed in the imaging mode, the digital camera **100** can enter the playback mode and display the latest image among the images recorded on a recording medium **200** on the display unit **28**.

(18) A menu button **81** is included in the operation unit **70**. In a case where the menu button **81** is pressed, a menu screen on which various settings can be set is displayed on the display unit **28**. The user can intuitively perform various settings on the menu screen displayed on the display unit **28** by using the directional pad **74** and the set button **75**.

(19) A multi-controller **82** can be tilted in 360-degree directions to receive key instructions each corresponding to different one of eight directions, such as up, down, left, and right directions. The multi-controller **82** can also be pressed to trigger an assigned function. A display mode switch

button **83** is an operation member for switching between a plurality of different display modes related to an LV image and information, such as imaging information, displayed on the display unit **28** or an electronic viewfinder (EVF) **29**. The display modes are switched each time the display mode switch button **83** is pressed, whereby an image can be captured and information about a reproduced image can be visually observed in the user-desired display mode.
(20) A communication terminal **10** is a communication terminal for the digital camera **100** to communicate with a lens unit (detachably attachable).
(21) An eyepiece unit **16** is an eyepiece portion of an eyepiece viewfinder (look-through viewfinder; hereinafter, referred to simply as a viewfinder). The user can visually observe a video image displayed on the EVF **29** provided inside through the eyepiece unit **16**. An eye proximity detection unit **57** is an eye proximity detection sensor for detecting whether the user's eye is put up to the eyepiece unit **16**. A lid **202** is a lid of a slot accommodating the recording medium **200**. A grip portion **90** is a holding portion having a shape easy for the user holding the digital camera **100** to grip by the right hand. The shutter button **61** and the main electronic dial **71** are disposed at positions operable with the right index finger in a state where the digital camera **100** is held with the grip portion **90** gripped with the right little finger, ring finger, and middle finger. The sub electronic dial **73** is disposed at a position operable with the right thumb in the same state.
(22) FIG. **2** is a block diagram illustrating a configuration example of the digital camera **100** according to the present exemplary embodiment. In FIG. **2**, a lens unit **150** is an interchangeable lens unit including an imaging lens. A lens **103** usually consists of a plurality of lenses but is illustrated as a single lens here for the sake of simplicity. A communication terminal **6** is a communication terminal of the lens unit **150** to communicate with the digital camera **100**. The communication terminal **10** is the communication terminal of the digital camera **100** to communicate with the lens unit **150**. The lens unit **150** communicates with a system control unit **50** via the communication terminals **6** and **10**. A lens system control circuit **4** in the lens unit **150** controls a diaphragm **1** via a diaphragm drive circuit **2**, and adjust the focus by displacing the lens **103** via an automatic focus (AF) drive circuit **3**. Moreover, the system control unit **50** identifies the type of lens unit **150** attached to the digital camera **100** via the communication terminals **6** and **10**.
(23) A shutter **101** is a focal plane shutter that can freely control exposure time of an imaging unit **22** under control of the system control unit **50**.
(24) The imaging unit **22** is an image sensor including a charge-coupled device (CCD) sensor or a complementary metal-oxide-semiconductor (CMOS) sensor for converting an optical image into an electrical signal. The imaging unit **22** may include an image plane phase difference sensor that outputs defocus amount information to the system control unit **50**. An analog-to-digital (A/D) converter **23** converts an analog signal into a digital signal. The A/D converter **23** is used to covert an analog signal output from the imaging unit **22** into a digital signal.
(25) An image processing unit **24** performs predetermined resize processing, such as pixel interpolation and reduction, and color conversion processing on data from the A/D converter **23** or data from a memory control unit **15**. The image processing unit **24** also performs predetermined calculation processing using captured image data. The system control unit **50** performs exposure control and ranging control based on the calculation result obtained by the image processing unit **24**. Based on the controls, through-the-lens (TTL) AF processing, automatic exposure (AE) control, and electronic flash (EF) (preliminary flash emission) processing are performed. The image processing unit **24** further performs predetermined calculation processing using the captured image data, and performs TTL automatic white balance (AWB) processing based on the calculation result obtained by the image processing unit **24**.
(26) Data output from the A/D converter **23** is written to a memory **32** via the image processing unit **24** and the memory control unit **15**, or directly via the memory control unit **15**. The memory **32** stores image data that is obtained by the imaging unit **22** and digitally converted by the A/D converter **23**, and image data to be displayed on the display unit **28** and the EVF **29**. The memory

**32** has a sufficient storage capacity to store a predetermined number of still images or a predetermined duration of moving image and audio data.

(27) The memory **32** also serves as an image display memory (video memory). A digital-to-analog (D/A) converter **19** converts image display data stored in the memory **32** into an analog signal and supplies the analog signal to the display unit **28** and the EVF **29**. The image display data written to the memory **32** is thus displayed on the display unit **28** and the EVF **29** via the D/A converter **19**. The display unit **28** and the EVF **29** perform display based on the analog signal from the D/A converter **19** on respective display devices, which are a liquid crystal display (LCD) and an organic electroluminescence (EL) display, for example. An LV display can be provided by converting digital signals, which have been once A/D-converted by the A/D converter **23** and stored in the memory **32**, into analog signals by the D/A converter **19** and successively transferring the analog signals to the display unit **28** or the EVF **29**. The image displayed by the LV display will hereinafter be referred to as an LV image.

(28) Various setting values of the digital camera **100**, including the shutter speed and the aperture value, are displayed on the external-viewfinder display unit **43** via an external-viewfinder display unit drive circuit **44**.

(29) A nonvolatile memory **56** is an electrically erasable and recordable memory. For example, an electrically erasable programmable read-only memory (EEPROM) is used as the nonvolatile memory **56**. The nonvolatile memory **56** stores operating constants of the system control unit **50** and programs. As employed herein, the programs refer to ones for executing various processing procedures of flowcharts to be described below in the present exemplary embodiment.

(30) The system control unit **50** is a control unit including at least one processor or circuit, and perform entire control of the digital camera **100**. The system control unit **50** implements various processes according to the present exemplary embodiment to be described below by executing the foregoing programs recorded in the nonvolatile memory **56**. A system memory **52** is a random access memory (RAM), for example. The operating constants of the system control unit **50**, variables, and the programs read from the nonvolatile memory **56** are loaded into the system memory **52**. Moreover, the system control unit **50** performs display control by controlling the memory **32**, the D/A converter **19**, and the display unit **28**.

(31) A system timer **53** is a clocking unit that measures time to be used for various types of control and the time of a built-in clock.

(32) The operation unit **70** is operation means for inputting various operation instructions into the system control unit **50**.

(33) The mode change switch **60** included in the operation unit **70** is an operation member for switching the operation mode of the system control unit **50** to any one of a still image capturing mode, a moving image capturing mode, and the playback mode. The still image capturing mode includes the following modes: an automatic imaging mode, an automatic scene determination mode, a manual mode, an aperture priority mode (aperture value (Av) mode), a shutter speed priority mode (time value (Tv) mode), and a program AE mode (P mode). The still image capturing mode also includes various scene modes that have imaging settings specific to respective imaging scenes, as well as a custom mode. The user can switch directly to one of the modes using the mode change switch **60**. Alternatively, the user may once switch to an imaging mode list screen by using the mode change switch **60**, and then select one of a plurality of modes displayed and switch to the selected mode using another operation member. The moving image capturing mode may similarly include a plurality of modes.

(34) A first shutter switch **62** turns on to generate a first shutter switch signal SW**1** when the shutter button **61** on the digital camera **100** is operated halfway, i.e., half-pressed (imaging preparation instruction). In response to the first shutter switch signal SW**1**, imaging preparation operations, such as the AF processing, the AE processing, the AWB processing, and the EF processing are started.

(35) A second shutter switch **64** turns on to generate a second shutter switch signal SW**2** when the shutter button **61** is completely operated, i.e., fully pressed (imaging instruction). In response to the second shutter switch signal SW**2**, the system control unit **50** starts a series of imaging processing operations from reading of a signal from the imaging unit **22** to writing of a captured image to the recording medium **200** as an image file.
(36) The operation unit **70** serves as various operation members (receiving units) serving as input units for receiving operations from the user. The operation unit **70** includes at least the following operation members: the mode change switch **60**, the shutter button **61**, the main electronic dial **71**, the power switch **72**, the sub electronic dial **73**, the directional pad **74**, the set button **75**, the moving image button **76**, the zoom button **78**, the playback button **79**, the menu button **81**, and the multi-controller **82**. These operation members are collectively illustrated as operation members **70***b* instead of individual blocks.
(37) A power supply control unit **80** includes a battery detection circuit, a direct-current-to-direct-current (DC-DC) converter, and a switch circuit for switching blocks to be energized, and detects presence or absence of a battery attached, the type of battery, and a remaining battery level. The power supply control unit **80** also controls the DC-DC converter based on the detection results and instructions from the system control unit **50**, and supplies predetermined voltages to various components, including the recording medium **200**, for predetermined periods. A power supply unit **30** includes a primary battery, such as an alkali battery and a lithium battery, a secondary battery, such as a nickel-cadmium (NiCd) battery, a nickel-metal halide (NiMH) battery, and a lithium-ion (Li) battery, and/or an alternating-current (AC) adaptor.
(38) A recording medium interface (I/F) **18** is an I/F with the recording medium **200**, such as a memory card and a hard disk. The recording medium **200** is a recording medium for recording captured images, and includes a semiconductor memory or a magnetic disk.
(39) A communication unit **54** performs a wireless connection or a wired connection, and transmits and receives video and audio signals. The communication unit **54** can also connect to a wireless local area network (LAN) and the Internet. The communication unit **54** can also communicate with external equipment using Bluetooth® and Bluetooth® Low Energy. The communication unit **54** can transmit images captured by the imaging unit **22** (including the LV image) and images recorded on the recording medium **200**, and receive images and various types of other information from external equipment.
(40) An orientation detection unit **55** detects the orientation of the digital camera **100** with respect to the direction of gravity. Determination of whether an image captured by the imaging unit **22** is an image captured with the digital camera **100** held landscape or portrait can be performed based on an orientation detected by the orientation detection unit **55**. The system control unit **50** can add orientation information based on the orientation detected by the orientation detection unit **55** to the image file of the image captured by the imaging unit **22**, or rotate the image and record the rotated image. An acceleration sensor or a gyro sensor can be used as the orientation detection unit **55**. Motion of the digital camera **100** (such as a pan, tilt, lift-up, and whether the digital camera **100** is stationary) can also be detected using the acceleration sensor or gyro sensor that is the orientation detection unit **55**.
(41) The eye proximity detection unit **57** is an eye proximity detection sensor that detects an approach (eye proximity) and withdrawal (eye separation) of an eye (object) to/from the eyepiece unit **16** of the viewfinder (proximity detection). The system control unit **50** switches display (display state) and non-display (non-display state) of the display unit **28** and the EVF **29** based on a state detected by the eye proximity detection unit **57**. More specifically, in a case where the digital camera **100** is at least in an imaging standby state and the display destination switching is set to automatic switching, the system control unit **50** turns on the display unit **28** as a display destination and turns off the EVF **29** during a non-eye proximity state. The system control unit **50** turns on the EVF **29** as a display destination and turns off the display unit **28** during an eye proximity state.

(42) For example, an infrared proximity sensor can be used as the eye proximity detection unit **57**, and can detect an approach of an object to the eyepiece unit **16** of the viewfinder including the EVF **29**. In a case where an object approaches, infrared rays emitted from a light emitting portion (not illustrated) of the eye proximity detection unit **57** are reflected by the object and received by a light receiving portion (not illustrated) of the infrared proximity sensor. Determination of how close the object is to the eyepiece unit **16** (eye proximity distance) can also be performed based on the amount of infrared rays received. The eye proximity detection unit **57** can thus perform eye proximity detection to detect a proximity distance of the object to the eyepiece unit **16**.
(43) In a case where an object approaching the eyepiece unit **16** less than or equal to a predetermined distance is detected in a non-eye proximity state (non-approach state), eye proximity is detected. In a case where the object having been detected to be in proximity in an eye proximity state (approach state) moves away more than or equal to a predetermined distance from the eyepiece unit **16**, eye separation is detected. The threshold for detecting eye proximity and the threshold for detecting eye separation may be different. For example, the two thresholds may have hysteresis. After detection of eye proximity, the eye proximity state continues until eye separation is detected. After detection of eye separation, the non-eye proximity state continues until eye proximity is detected. The infrared proximity sensor is just an example. Other sensors that can detect an approach of an eye or object that can be detected for the eye proximity determination may be employed as the eye proximity detection unit **57**.
(44) The touch panel **70***a* and the display unit **28** may be integrally configured. For example, the touch panel **70***a* is configured so that its light transmittance does not interfere with display on the display unit **28**, and attached onto the display surface of the display unit **28**. Input coordinates of the touch panel **70***a* are associated with display coordinates on a display screen of the display unit **28**. This can provide a graphical user interface (GUI) that enables the user to perform operations as if the user directly operates the screen displayed on the display unit **28**. The system control unit **50** can detect the following operations or states of the touch panel **70***a*. A finger or a pen not touching the touch panel **70***a* newly touches on the touch panel **70***a*. In other words, a touch is started (hereinafter, referred to as a touch-down). A finger or a pen is touching the touch panel **70***a* (hereinafter, referred to as a touch-on). A finger or a pen touching the touch panel **70***a* moves (hereinafter, referred to as a touch-move). A finger or a pen touching the touch panel **70***a* is released. In other words, a touch is ended (hereinafter, referred to as a touch-up). Nothing touches the touch panel **70***a* (hereinafter, referred to as a touch-off).
(45) In a case where a touch-down is detected, a touch-on is simultaneously detected. After a touch-down, a touch-on usually continues to be detected until a touch-up is detected. A touch-move is also detected while a touch-on is being detected. In a case where a touch-on is detected and the touch position does not move, a touch-move is not detected. After a touch-up of all fingers or pens touching the touch panel **70***a* is detected, a touch-off is detected.
(46) Such operations and states and the position coordinates of a finger and a pen touching the touch panel **70***a* are notified to the system control unit **50** via an internal bus. The system control unit **50** determines what operation (touch operation) is performed on the touch panel **70***a* based on the notified information.
(47) In a touch-move, a moving direction of a finger or a pen moving on the touch panel **70***a* can be determined in terms of a vertical component and a horizontal component on the touch panel **70***a* separately based on a change in the position coordinates.
(48) In a case where a touch-move for a predetermined distance or more is detected, it is determined that a slide operation is performed. An operation of quickly moving a finger touching the touch panel **70***a* for some distance and immediately releasing the finger is referred to as a flick. In other words, a flick is an operation of quickly moving a finger over the touch panel **70***a* as if flicking. In a case where a touch-move is detected for a predetermined distance or more at a predetermined speed or higher and a touch-up is immediately detected, it is determined that a flick

is performed (it can be determined that a flick is performed immediately after a slide operation).
(49) Moreover, a touch operation of touching a plurality of positions (for example, two positions) together (performing a multi-touch) and bringing the touch positions closer to each other will be referred to as a pinch-in. A touch operation of separating the touch positions away from each other will be referred to as a pinch-out. A pinch-out and a pinch-in are referred to collectively as pinch operations (or simply pinches). The touch panel **70***a* may be a touch panel of any one of various methods including a resistive, capacitive, surface elastic wave, infrared, electromagnetic induction, image recognition, and optical sensor methods. Some methods detect a touch based on a contact on the touch panel. Some methods detect a touch based on approach of a finger or a pen to the touch panel. Either type may be used.
(50) FIG. **3** is a schematic diagram illustrating an example of a configuration of a lens unit **300**. FIG. **3** illustrates a state where the lens unit **300** is attached to the digital camera **100**. Among the components of the digital camera **100** illustrated in FIG. **3**, similar components to those described with reference to FIG. **2** are denoted by the same reference numerals. Redundant description of the components will be omitted as appropriate.
(51) The lens unit **300** is a type of interchangeable lens detachably attachable to the digital camera **100**. The lens unit **300** is a dual lens unit capable of obtaining left and right optical images having parallax. The lens unit **300** includes two optical systems (imaging lenses), each of which has a wide viewing angle of 180° and can capture an image of a hemispherical angle in front. Specifically, the two optical systems of the lens unit **300** can each input an optical object image having a field of view (angle of view) of 180° in a lateral direction (horizontal angle, azimuth angle, or yaw angle) and 180° in a vertical direction (vertical angle, elevation and depression angle, or pitch angle).
(52) The lens unit **300** includes a right-eye optical system **301**R including a plurality of lenses and reflection mirrors, a left-eye optical system **301**L including a plurality of lenses and reflection mirrors, and a lens system control circuit **303**. The right-eye optical system **301**R corresponds to an example of a first optical system. The left-eye optical system **301**L corresponds to an example of a second optical system. The right-eye optical system **301**R and the left-eye optical system **301**L include a lens **302**R and a lens **302**L, respectively, which are disposed on the object side and directed in the similar direction and have optical axes parallel to each other. Each of the right-eye optical system **301**R and the left-eye optical system **301**L is a fisheye lens and forms a circular optical image on the imaging unit **22** (sensor). The optical image input via the left-eye optical system **301**L (left image) and the optical image input via the right-eye optical system **301**R (right image) are formed on an imaging surface of a single imaging unit which is the imaging unit **22**. The imaging unit **22** obtains an image including optical images of both of the right-eye optical system **301**R and the left-eye optical system **301**L.
(53) The lens unit **300** according to the present exemplary embodiment is a VR180 lens (dual lens unit) for capturing a VR180 image. VR180 is a virtual reality (VR) image format for a dual-lens stereoscopic view. As the VR180 lens, each of the right- and left-eye optical systems **301**R and **301**L includes a fisheye lens that can capture a 180-degree angle. As the VR180 lens, lenses capable of covering a wide viewing angle of approximately 160° narrower than the 180-degree angle of view can also be used as long as the right- and left-eye optical systems **301**R and **301**L can each capture a video image for a VR180 dual-lens VR display. The VR180 lens can form the right image (first image) via the right-eye optical system **301**R and the left image (second image), having parallax with the right image, via the left-eye optical system **301**L on one or two image sensors of a camera to which the VR180 lens is attached. The digital camera **100** according to the present exemplary embodiment has a configuration in which the right image and the left image are formed on one image sensor (sensor), which is the imaging unit **22**, to generate an image (dual-lens image) where an image corresponding to the right image and an image corresponding to the left image are laterally arranged. The dual-lens image here includes the image corresponding to the right image, the image corresponding to the left image, and an area where no optical image is formed (black

area).
(54) The lens unit **300** is attached to the digital camera **100** via a lens mount unit **304** of the lens unit **300** and a camera mount unit **305** of the digital camera **100**. Thus, the system control unit **50** of the digital camera **100** and a lens system control circuit **303** of the lens unit **300** are electrically connected via the communication terminal **10** of the digital camera **100** and a communication terminal **306** of the lens unit **300**.
(55) In the present exemplary embodiment, the right image formed via the right-eye optical system **301**R and the left image formed via the left-eye optical system **301**L having parallax with the right image are formed on the imaging unit **22** of the digital camera **100** side by side. In other words, the two optical images formed by the right- and left-eye optical systems **301**R and **301**L are formed on one image sensor. The imaging unit **22** converts the formed object image (light signal) into an analog electrical signal to obtain image data on the dual-lens image. Using the lens unit **300**, two images having parallax can thus be obtained simultaneously (as a set) from two components (optical systems), namely, the right-eye optical system **301**R and the left-eye optical system **301**L. Moreover, the user can view a stereoscopic VR image having the 180-degree angle of view, i.e., VR180 image, by dividing the obtained image into a left-eye image and a right-eye image and displaying the divided images in a VR manner.
(56) With a conventional ordinary single-lens unit, an optical image incident on the lens unit is symmetrically inverted about a point of the optical axis center and input to the image sensor. An imaging apparatus like the digital camera **100** generates a realistic (not inverted) image by performing processing for reversing the reading order of the image sensor or inverting the read image. With a dual-lens unit, the input optical images are vertically symmetrically inverted but not laterally, i.e., the left image obtained via the left-eye optical system is input to the left area of the image sensor and the right image obtained via the right-eye optical system is input to the right area of the image sensor. When the conventional inversion processing is performed on such an image, the left and right with respect to the digital camera **100** become reverse to the left and right of the inverted image. Specifically, the left image obtained via the left-eye optical system is displayed to the right, and the right image obtained via the right-eye optical system is displayed to the left.
(57) As employed herein, a VR image refers to an image capable of VR display to be described below. Examples of VR images include an omnidirectional image (spherical image) captured by an omnidirectional camera (spherical camera), and a panoramic image having a wider video angle of view (effective video angle) than a display angle capable of being displayed on a display unit at a time. VR images are not limited to still images and may also include a moving image and a live image (image obtained from a camera almost in real time). A VR image has a video angle of view (effective video angle) corresponding to a field of view of up to 360° in the lateral direction and 360° in the vertical direction. Even if an angle of view of an image is less than 360° in the lateral direction and less than 360° in the vertical direction, the image can also be included in VR images as images having a wider angle of view than an angle of view of an ordinary camera or images having a wider video angle of view than a display angle capable of being displayed on a display unit at a time. An image captured by the digital camera **100** using the lens unit **300** is a type of VR image. A VR image can be VR-displayed, for example, by setting the display mode of a display apparatus (display apparatus capable of displaying a VR image) to a “VR view”. The user can view a laterally seamless omnidirectional video image by VR-displaying a VR image having an angle of view of 360° and changing the orientation of the display apparatus in the lateral direction (horizontal rotational direction).
(58) As employed herein, a VR display (VR view) refers to a display method (display mode) for displaying a video image having a field of view corresponding to an orientation of the display apparatus and capable of changing the display area of the VR image. An example of the VR display is a “single-lens VR display (single-lens VR view)” that is for displaying a single image by transforming a VR image to perform mapping onto an imaginary sphere (transforming with

distortion correction). Another example of the VR display is a “dual-lens VR display (dual-lens VR view)” that is for displaying images in the left and right areas side by side by individually transforming a VR image for the left eye and a VR image for the right eye to perform mapping onto respective imaginary spheres. A “dual-lens VR display” using a left-eye VR image and a right-eye VR image having parallax enables a stereoscopic view.

(59) In any VR display, if, for example, the user wears a display apparatus, such as a head-mounted display (HMD), a video image having the field of view corresponding to the direction of the user's face is displayed. For example, in a case where a video image, of a VR image, having a field of view centered at 0° in the lateral direction (specific azimuth, such as the north) and 90° in the vertical direction (90° from the zenith, i.e., horizontal) is being displayed at a point in time, and when the orientation of the display apparatus is reversed (for example, the displaying side is turned from southward to northward), the display area is changed to a video image, of the same VR image, having a field of view centered at 180° in the lateral direction (reverse azimuth, such as the south) and 90° in the vertical direction. In other words, when the user wearing the HMD turns the user's head from the north to the south (i.e., turns back), the video image displayed on the HMD is also changed from a north image to a south image.

(60) A VR image captured by using the lens unit **300** according to the present exemplary embodiment is a VR180 image having a 180-degree angle in front, without a video image of a 180-degree angle behind. If such a VR180 image is VR-displayed and the orientation of the display apparatus is changed to a side where there is no video image, a blank area is displayed.

(61) Such VR display of a VR image visually makes the user feel as if being in the VR image (VR space). The method for displaying the VR image is not limited to that including changing the orientation of the display apparatus. For example, the display area may be moved (scrolled) based on a user operation using the touch panel **70***a* or the directional pad **74**. During a VR display (during the display mode “VR view”), the display area may be changed based on a touch-move operation performed on the touch panel **70***a*, a drag operation performed on a mouse, or pressing of the directional pad **74** in addition to the change of the display area based on a change in orientation. A smartphone attached to a VR goggle (head-mount adaptor) is a type of HMD.

(62) A dual-lens image captured by the digital camera **100** configured as described above via the lens unit **300** is an image including the right image and the left image input to the imaging unit **22** via the right-eye optical system **301**R and the left-eye optical system **301**L. The user using the digital camera **100** may enlarge and display a part of an LV image or a part of a recorded image to check for details. In enlarging an image, a center position of an area to be enlarged in the image may be consistently set at the center position of the entire image.

(63) In a case of enlarging a part of a dual-lens image to check for details of the dual-lens image, a part of one of the right and left images is desirably displayed. If the center position of the area to be enlarged in the image is consistently set at the center of the entire image, parts of both the right and left images are included in the enlarged image. This causes difficulty for the users in intuitively identifying which part of the original image is displayed as the enlarged image. Specifically, in the enlarged image, a left end portion of the right image is displayed on the right and a right end portion of the left image is displayed on the left, which is an image having a lateral positional relationship different from that in the image capturing field of view.

(64) A description will be given of a flowchart illustrated in FIG. **4** to describe processing that is performed by the digital camera **100** for performing LV zoom processing suitable in image capturing using a dual-lens unit like the lens unit **300** in the present exemplary embodiment.

(65) FIG. **4** is a flowchart illustrating an example of the processing that is performed by the digital camera **100** in the imaging mode. The flowchart of FIG. **4** is implemented by the system control unit **50** loading a program stored in the nonvolatile memory **56** into the system memory **52** and executing the program. The flowchart of FIG. **4** is started when the digital camera **100** is in the imaging standby state after the power is turned on. When a processing procedure of the flowchart

(hereinafter, may be referred to as a control flowchart) of FIG. **4** is started, the system control unit **50** initializes control variables and starts processing.
(66) Display examples of the display unit **28** in executing the processing procedure of the control flowchart of FIG. **4** will be described with reference to FIGS. **5**A to **5**F. Details of the display examples illustrated in FIGS. **5**A to **5**F will be described after the description of the control flowchart of FIG. **4**.
(67) In step S**401**, the system control unit **50** obtains a display mode used last time based on a flag (N) stored in the nonvolatile memory **56**, and displays an LV image or images and/or information about imaging on the display unit **28**, based on the display mode used last time. For example, in a case where the processing procedure of the flowchart is started by power-on, the display mode used last time corresponds to a mode at a timing of when the digital camera **100** has been powered off the last time. In a case where the flowchart is started by switching from a mode other than the imaging mode, such as the playback mode, to the imaging mode, the display mode used last time corresponds to a mode at the timing of when processing has been performed in the imaging mode the last time.
(68) In step S**402**, the system control unit **50** determines whether the display mode switch button **83** is pressed. In a case where the display mode switch button **83** is pressed (YES in step S**402**), the processing proceeds to step S**403**. In a case where the display mode switch button **83** is not pressed (NO in step S**402**), the processing proceeds to step S**410**.
(69) In step S**403**, the system control unit **50** refers to the system memory **52** and determines whether the flag N indicating the display mode is 5 (N=5). In a case where the flag N is 5 (YES in step S**403**), the processing proceeds to step S**404**. In a case where the flag N is not 5 (NO in step S**403**), the processing proceeds to step S**405**.
(70) In step S**404**, the system control unit **50** determines whether the lens unit attached via the communication terminals **6** and **10** is a dual-lens unit. In a case where the attached lens unit is a dual-lens unit (YES in step S**404**), the processing proceeds to step S**406**. In a case where the attached lens unit is not a dual-lens unit (i.e., the attached lens unit is an ordinary single-lens unit or no lens unit is attached) (NO in step S**404**), the processing proceeds to step S**408**. The dual-lens unit includes a left lens and a right lens, each of which is a wide-angle fisheye lens capable of capturing an image, of the side where the lens is disposed, having at least a 180-degree angle of view on the object-side. A left image and a right image formed in the left-eye optical system **301**L and the right-eye optical system **301**R can be captured by one or two image sensors.
(71) In step S**405**, the system control unit **50** increments the flag N indicating the display mode by one (N=N+1), and stores the flag N in the system memory **52**.
(72) In step S**406**, the system control unit **50** sets the flag N to 6 (N=6), and stores the flag N in the system memory **52**.
(73) In step S**407**, the system control unit **50** displays the LV images and/or information in a display mode dedicated to a dual-lens unit on the display unit **28**. FIG. **5**F illustrates a display example of this processing. FIG. **5**F will be described in detail below.
(74) In step S**408**, the system control unit **50** sets the flag N to 1 (N=1), and stores the flag N in the system memory **52**.
(75) In step S**409**, the system control unit **50** displays the LV image(s) and/or information on the display unit **28** in the display mode corresponding to the numerical value of the flag N stored in the system memory **52**. FIGS. **5**A to **5**E illustrate display examples, displayed on the display unit **28**, each corresponding to different one of display mode. Since the processing can also reach this step S**409** in the case where the determination of step S**404** is NO, the LV image(s) and/or information on the display unit **28** is also displayed in the display mode corresponding to the numerical value of the flag N (N=1) even in a case where a dual-lens unit is not attached, i.e., in a case where a single-lens unit is attached or no lens unit is attached.
(76) The display examples of the LV image and information displayed on the display unit **28** will

be described with reference to FIGS. **5**A to **5**F. FIGS. **5**A to **5**D and **5**F illustrate a case where a dual-lens unit is attached to the digital camera **100** and two LV images are displayed. In a case where a single-lens unit is attached, a similar display is provided except that one LV image is displayed. In a case where a single-lens unit is attached, as described above with reference to FIG. **4**, the display mode will not transition to a mode for display illustrated in FIG. **5**F. The information displayed on the display unit **28** is changed each time the user performs a display mode change operation (in the present exemplary embodiment, presses the display mode switch button **83**). Specifically, the system control unit **50** provides any one of displays of FIGS. **5**A to **5**F based on the numerical value of the flag N each indicating a different display mode, described above with reference to FIG. **4**. In the present exemplary embodiment, the LV images displayed on the display unit **28** are circular fisheye display. However, equirectangular conversion processing may be performed on the circular fisheye display of the LV images to provide equirectangular display.

(77) FIG. **5**A illustrates a display mode of a case where the flag N=1, i.e., in a case where the digital camera **100** is powered on and LV images are displayed on the display unit **28** in the imaging standby state. Two laterally arranged LV images (hereinafter, may be referred to as an LV image **500**R and an LV image **500**L) are displayed on the display unit **28** along with information displays **501***a* to **501***c*. The two laterally arranged LV images here will be referred to as side-by-side images. The information displays **501***a* to **501***c* indicate minimum imaging information considered to be desirable when the user captures an image. In a case where the display mode switch button **83** is pressed in the state illustrated in FIG. **5**A, the display mode transitions to a display mode illustrated in FIG. **5**B.

(78) FIG. **5**B illustrates a display mode of a case where the flag N=2. In FIG. **5**B, information displays **502***a* and **502***b* are displayed in addition to the LV images **500**R and **500**L, and the information displays **501***a* to **501***c*. Like the information displays **501***a* to **501***c*, the information displays **502***a* and **502***b* indicate various types of imaging information related to imaging (for example, currently set setting values and the type of recording medium **200** inserted). Since the amount of information increases in addition to the information displays **501***a* to **501***c*, the user can visually observe more imaging information. Meanwhile, the visibility of the LV images can drop. In a case where the display mode switch button **83** is pressed in the state illustrated in FIG. **5**B, the display mode transitions to a display mode illustrated in FIG. **5**C.

(79) FIG. **5**C illustrates a display mode of a case where the flag N=3. In FIG. **5**C, an information display **503** that is a histogram of the currently captured LV images is displayed in addition to the LV images **500**R and **500**L, and the information displays **501***a* to **501***c*, **502***a*, and **502***b*. The information display **503** is a graph with brightness on the lateral axis and the number of pixels on the vertical axis. The information display **503** provides a rough indication of how bright the currently captured LV images are, the tendency of exposure levels, and the gradations of the entire LV images. The information display **503** is displayed since some users may want to check it during imaging. The information display **503** is superimposed on a relatively large area of the LV image **500**L and thus causes a drop in visibility. In a case where the display mode switch button **83** is pressed in the state illustrated in FIG. **5**C, the display mode transitions to a display mode illustrated in FIG. **5**D.

(80) FIG. **5**D illustrates a display mode of a case where the flag N=4. In the display mode of FIG. **5**D, all the information displays **501***a* to **501***c*, **502***a*, **502***b*, and **503** are hidden and only the LV images **500**R and **500**L are displayed. Such a display enables the user to perform image capturing while visually observing only the LV images without being bothered by various types of imaging information. In a case where the display mode switch button **83** is pressed in the state illustrated in FIG. **5**D, the display mode transitions to a display mode illustrated in FIG. **5**E.

(81) FIG. **5**E illustrates a display mode of a case where the flag N=5. In the display mode of FIG. **5**E, the LV images **500**R and **500**L are not displayed, and only imaging-related information is displayed in a table-like form. In a case where the display mode switch button **83** is pressed in the

state illustrated in FIG. **5**E, and when a dual-lens unit is attached, the display mode transitions to that illustrated in FIG. **5**F, and when a single-lens unit is attached or no lens unit is attached, the display mode transitions to that illustrated in FIG. **5**A.

(82) FIG. **5**F illustrates a display mode of a case where the flag N=6 (step S**407** in FIG. **4**). Specifically, this display mode is entered in a case where a dual-lens unit is attached to the digital camera **100**. Here, the display unit **28** displays the LV images **500**R and **500**L, information displays **505** and **506**, and a zoom frame **511**, a focus guide **512**, and magic windows **513**R and **513**L (hereinafter, collectively referred to magic windows **513**) which are superimposed on the LV images. The information display **505**, or "R" meaning right, indicates that the LV image **500**R is the LV image (right image) captured by the right-eye optical system **301**R. The information display **506**, or "L" meaning left, indicates that the LV image **500**L is the LV image (left image) captured by the left-eye optical system **301**L.

(83) In an optical system, such as the optical system in the digital camera **100**, the image captured by the image sensor (imaging unit **22**) is vertically inverted. The vertically inverted image is vertically inverted by 180° and displayed on the display unit **28** or the EVF **29**. With such a structure taken into account, the case of image capturing using the lens unit (dual-lens unit) including the left- and right-eye optical systems **301**L and **301**R illustrated in FIG. **3** will be described. As described above, if two LV images captured via the left- and right-eye optical systems **301**L and **301**R and input to the imaging unit **22** are displayed on the display unit **28** without inversion processing, the vertically inverted LV images are displayed, which impairs usability. Inversion processing is thus performed on the two LV images input to the imaging unit **22** as in the case where a single-lens unit is attached.

(84) However, when the inversion processing is performed, the two LV images are displayed on the display unit **28** in such a manner that the LV image (right image) obtained via the right-eye optical system **301**R is displayed in the left area, and the LV image (left image) obtained via the left-eye optical system **301**L is displayed in the right area. In particular, in the present exemplary embodiment, a processing load of processing for identifying a border between the two LV images on the image sensor and replacing the left and right LV images would be high in the system control unit **50** since the two LV images are captured using one image sensor (imaging unit **22**). The LV images input to the imaging unit **22** are thus vertically inverted by 180° and displayed on the display unit **28** without replacing the left and right images.

(85) When two LV images are displayed on the display unit **28**, the user usually considers that the LV image displayed in the left area is the one captured by the left-eye optical system **301**L, and the LV image displayed in the right area is the one captured by the right-eye optical system **301**R. In other words, without the information displays **505** and **506**, the user is likely to miss the fact that the left and right LV images are laterally reversed, and can get confused during imaging unless the user is aware of the lateral reversal. Thus, the information displays **505** and **506** are displayed so that the user can clearly visually recognize which LV image is captured by which of the left- and right-eye optical systems **301**L and **301**R.

(86) The zoom frame **511** superimposed on the LV image **500**L is a frame display that indicates the area to be enlarged in the LV image **500**L in response to a zoom instruction (to be described below in step S**801** of FIG. **8**A) issued by the user. The focus guide **512** includes a frame indicating a focus detection area and an indicator displaying a degree of in-focus on an object at the position where the frame is superimposed, using markers or color information. In the present exemplary embodiment, the degree of in-focus is expressed by three markers displayed above or below the focus detection area. The focus guide **512** in FIG. **5**F shows that the object at the position where the frame is displayed is not in focus and in a state of rear focus (the in-focus position is behind the object and the object is not in focus). In a case where the object is not in focus, the focus guide **512** is displayed in white. Once in-focus state is achieved, the three markers are changed to two markers, and the focus guide **512** is displayed in green.

(87) The magic windows **513** are indicators displayed on the display unit **28** and indicate areas to be initially displayed before the user moves the point of view. The magic windows **513** indicate areas to be initially displayed before the user moves the point of view in generating a 180-degree image (hemispherical image) from the LV images **500**R and **500**L and reproducing the 180-degree image on a browser or an HMD. Since the magic windows **513** are displayed on the LV images **500**R and **500**L, the areas to be initially displayed during playback, i.e., the initial areas for the viewer to view can be visually observed during imaging. The user can thus more effectively capture an image of a desired object in a desired composition.

(88) The magic windows **513** are indicators for generating a 180-degree image, i.e., special indicators considered to be particularly useful to the user in image capturing using a dual-lens unit attached on the digital camera **100**. The display mode illustrated in FIG. **5**F is thus not displayed when a single-lens unit is attached. Since the magic windows **513** are displayed at fixed positions, and magic windows **513** are not needed to be constantly displayed in subsequent imaging operations after the user checks the areas of the magic windows **513**.

(89) In the present exemplary embodiment, the zoom frame **511** and the focus guide **512** are superimposed on one of the LV images **500**R and **500**L. The magic windows **513** are superimposed on the respective images of the LV images **500**R and **500**L. The zoom frame **511** indicates the position to be enlarged, and is thus desirably displayed singly. By contrast, the focus guide **512** may be displayed on each of the two LV images instead of one.

(90) Next, processing in a case where a touch-down operation is performed on the touch panel **70***a* will be described. The system control unit **50** of the digital camera **100** displays an item related to focus control and an item indicating a zoom area in the image, in response to a touch-down operation performed on the touch panel **70***a* during image display. In a case where the lens unit attached to the digital camera **100** is not a dual-lens unit (but a conventional single-lens unit), the system control unit **50** displays a focus guide indicating the degree of in-focus or an AF frame indicating an AF target area at a position corresponding to the touch-down. In a case where the lens unit attached to the digital camera **100** is a dual-lens unit, the system control unit **50** displays the focus guide indicating the degree of in-focus at the center of either one of the area displaying the left image and the area displaying the right image (return to the center), in response to the touch-down operation. The system control unit **50** further displays a zoom frame indicating the zoom area at the position corresponding to the touch-down. In a case where the lens unit attached to the digital camera **100** is a dual-lens unit, the system control unit **50** displays the zoom frame at a position not including both the left and right images.

(91) In step S**410**, the system control unit **50** determines whether a touch-down operation is performed on the touch panel **70***a*. In a case where a touch-down operation is performed (YES in step S**410**), the system control unit **50** stores coordinates (xt, yt) indicating a position of the touch-down operation (touch position), and the processing proceeds to step S**411**. In a case where a touch-down operation is not performed (NO in step S**410**), the processing proceeds to step S**601** of FIG. **6**A.

(92) In step S**411**, like step S**404**, the system control unit **50** determines whether the lens unit attached via the communication terminals **6** and **10** is a dual-lens unit. In a case where the attached lens unit is a dual-lens unit (YES in step S**411**), the processing proceeds to step S**412**. In a case where the attached lens unit is not a dual-lens unit (NO in step S**411**), the processing proceeds to step S**421**.

(93) In step S**412**, the system control unit **50** determines whether the touch position (touch-down position) of the touch-down operation performed on the touch panel **70***a* in step S**410** falls within the right area (area **701**R) of the dual-lens image. FIGS. **7**A and **7**B are schematic diagrams illustrating a display example where a dual-lens image is displayed. In a case where the touch position falls within the right area (area **701**R) (YES in step S**412**), the processing proceeds to step S**413**. In a case where the touch position falls within the left area (area **701**L) (NO in step S**412**),

the processing proceeds to step S**417**. A line **705** is the borderline between the LV images (LV **700**R and LV **700**L) captured by the right- and left-eye optical systems **301**R and **301**L, respectively. In the present exemplary embodiment, the line **705** is the centerline by which the imaging unit **22** is divided into two areas of the left and right areas.

(94) In step S**413**, the system control unit **50** displays the focus guide at the center of the right area (returns the display position to the center). In a case where the focus guide has already been superimposed on the LV image in the left or right area, the focus guide is moved to the center of the right area (center of the LV image which is captured by the left-eye optical system **301**L and displayed in the right area). The focus guide **512** in FIG. **5**F is a display example here. The focus guide includes a frame indicating the focus detection area and a plurality of markers that indicates the degree of in-focus in the focus detection area using a relationship between respective display positions of the markers. Based on the relationship between the display positions of the markers, the user can visually observe whether the object at the display position of the focus detection area is in focus, how far the object is out of focus, and to which side of forward or rear the object in the focus detection area is out of focus when the object is out of focus. The display mode of the focus guide is not limited the above-described configuration. For example, the focus guide may indicate the degree of in-focus using colors.

(95) In step S**414**, the system control unit **50** determines whether the touch position of the touch-down operation performed on the touch panel **70***a* in step S**410** is near the border. Specifically, the system control unit **50** determines whether the touch position falls within an area between the line **705** illustrated in FIGS. **7**A and **7**B and a line at a predetermined distance to the right from the line **705**. In a case where the touch position falls within the area (YES in step S**414**), the processing proceeds to step S**415**. In a case where the touch position does not fall within the area (NO in step S**414**), the processing proceeds to step S**416**. The predetermined distance here is one half the lateral length of the zoom frame. The predetermined distance can be freely set. The position on the touch panel **70***a* is expressed in an xy coordinate system. The x coordinate of the line at the predetermined distance to the right from the line **705** will be denoted by a coordinate Rmin. In other words, in a case where the x component of the center coordinates of the zoom frame is the coordinate Rmin, the left side of the zoom frame touches (overlaps) the line **705**. In a case where the x component of the center coordinates of the zoom frame is less than the coordinate Rmin, i.e., falls within an area **702**R, the zoom frame extend over the border between the left and right areas.

(96) In step S**415**, the system control unit **50** displays the zoom frame with the center of the zoom frame at coordinates (Rmin, yt). By such control, even in a case where the user performs the touch-down operation near the line **705**, the zoom frame is displayed in a state not crossing the line **705** and including only the image in the right area.

(97) In step S**416**, the system control unit **50** displays the zoom frame with the center of the zoom frame at the coordinates (xt, yt) of the touch position.

(98) In step S**417**, the system control unit **50** displays the focus guide at the center of the left area (center of the LV image displayed in the left area, captured by the right-eye optical system **301**R). In a case where the focus guide has already been superimposed on the LV image, the system control unit **50** moves the focus guide to the center of the left area.

(99) In step S**418**, the system control unit **50** determines whether a touch position of the touch-down operation performed on the touch panel **70***a* in step S**410** falls within an area between the line **705** illustrated in FIGS. **7**A and **7**B and a line at a predetermined distance to the left from the line **705**. In a case where the touch position falls within the area (YES in step S**418**), the processing proceeds to step S**419**. In a case where the touch position does not fall within the area (NO in step S**418**), the processing proceeds to step S**420**. As described in step S**414**, the predetermined distance is one half the lateral length of the zoom frame. The predetermined distance may be freely set by the user. Here, an x coordinate of the line at the predetermined distance to the left from the line **705** will be denoted by a coordinate Lmax. In other words, in a case where the x component of the

center coordinates of the zoom frame is the coordinate Lmax, the right side of the zoom frame touches (overlaps) the line **705**. In a case where the x component of the center coordinates of the zoom frame is greater than the coordinate Lmax, i.e., falls within an area **702**L, the zoom frame extend over the border between the left and right areas.

(100) In step S**419**, the system control unit **50** displays the zoom frame with the center of the zoom frame at coordinates (Lmax, yt).

(101) In step S**420**, the system control unit **50** displays the zoom frame with the center of the zoom frame at the coordinates (xt, yt) of the touch position.

(102) By the above-described control, even in a case where the user designates the position of the zoom frame by performing a touch operation on an area including the vicinity of the line **705**, the zoom frame is prevented from being displayed over both the left and right areas. If the zoom frame is displayed over both the left and right areas and the user performs a zoom operation (press the zoom button **78**), as will be described below, the border between the left and right LV images is enlarged, which can confuse the user. Thus, according to the present exemplary embodiment, the zoom frame is prevented from being displayed over both the left and right areas.

(103) Next, control to be performed in response to the touch-down operation in a case where the lens attached to the digital camera **100** is not a dual-lens unit (but a single-lens unit) will be described.

(104) In step S**421**, the system control unit **50** refers to the nonvolatile memory **56**, and determines whether a focus mode is set to an AF mode or a manual focus (MF) mode. In a case where the focus mode is set to the MF mode (NO in step S**421**), the processing proceeds to step S**422**. In a case where the focus mode is set to the AF mode (YES in step S**421**), the processing proceeds to step S**423**. In a case where the focus mode is the MF mode and a focus guide display setting is on, the system control unit **50** displays the focus guide for assisting focusing by MF operations.

(105) In step S**422**, the system control unit **50** moves the focus guide to the touch position designated by the user in step S**410**.

(106) In step S**423**, the system control unit **50** displays an AF frame indicating the in-focus position at the touch position designated by the user in step S**410**.

(107) In step S**424**, the system control unit **50** displays the zoom frame at the touch position of the touch-down operation performed in step S**410**.

(108) In other words, in a case where the lens unit attached to the digital camera **100** is not a dual-lens unit (but a single-lens unit), the zoom frame and the focus guide are displayed at the user's touch position regardless of the settings of the focus mode. The zoom frame is displayed in a manner linked with the AF frame and the focus detection area indicated by the focus guide. By contrast, in a case where a dual-lens unit is attached, the display position of the zoom frame is not linked with the focus detection area indicated by the focus guide.

(109) In the present exemplary embodiment, in a case where a dual-lens unit is attached, the display position of the focus guide is fixed to the center of the display area of the left or right LV image. If the display position of the focus guide and the display position of the zoom frame are moved in synchronization with each other, a zoom area is limited to the center area of the LV image, which leads to poor usability. Moreover, in a case where a dual-lens unit is attached, two LV images are displayed on the display unit **28**. Consequently, each LV image has a size less than or equal to one half the size of the LV image of when a single-lens unit is attached. The user is thus likely to enlarge the LV images and check the LV images in more details a greater number of times than when a single-lens unit is attached. The zoom frame (i.e., the zoom area of the LV images) is thus not linked with the focus guide, so that the user can freely check desired positions.

(110) The focus guide may be configured to not be fixed to the center. Even in such a case, the focus guide and the zoom frame are not moved in synchronization with each other when a dual-lens unit is attached. The user finely adjusting the focus using the focus guide may also want to zoom in on a position other than the focus position to observe more details. For example, in a case where

the user wants to zoom in the inside areas of the foregoing magic windows or areas near the circumferences of the LV images in the circular fisheye display and observe the enlarged areas, unlinking the positions of the focus guide and the zoom frame provides better operability for the user.

(111) FIGS. **6**A and **6**B are a control flowchart about display control of the digital camera **100** in a case where an operation member capable of issuing directional instructions according to the present exemplary embodiment is operated.

(112) The system control unit **50** of the digital camera **100** moves the position of an item, such as the zoom frame, (designates the position of the item) in a dual-lens image in response to a directional instruction during displaying of the dual-lens image and the item. In a case where the lens unit attached to the digital camera **100** is not a dual-lens unit (but a conventional single-lens unit), the system control unit **50** moves the focus guide or the AF frame, and the zoom frame, based on the directional instruction.

(113) In a case where the lens unit attached to the digital camera **100** is a dual-lens unit, the system control unit **50** moves the zoom frame based on the directional instruction. Here, the system control unit **50** does not move the focus guide. Further, the zoom frame is displayed in the right area of the display unit **28** in such a manner that the zoom frame does not include both the left and right images. In response to an instruction to move the zoom frame displayed near the border to the left, the system control unit **50** moves the display position of the zoom frame to the left area. The zoom frame is displayed in the left area of the display unit **28** in such a manner that the zoom frame does not include both the left and right images. In response to an instruction to move the zoom frame displayed near the border to the right, the system control unit **50** moves the display position of the zoom frame to the left area.

(114) In step S**601**, the system control unit **50** determines whether a directional instruction is issued using the multi-controller (MC) **82** or the directional pad **74** of the operation unit **70**. In a case where a directional instruction is issued (YES in step S**601**), the processing proceeds to step S**602**. In a case where a directional instruction is not issued (NO in step S**601**), the processing proceeds to step S**617**.

(115) In step S**602**, like step S**411**, the system control unit **50** obtains the type of lens unit attached via the communication terminals **6** and **10**, and determines whether the lens unit is a dual-lens unit. In a case where the attached lens unit is a dual-lens unit (YES in step S**602**), the processing proceeds to step S**607**. In a case where the attached lens unit is not a dual-lens unit (NO in step S**602**), the processing proceeds to step S**603**.

(116) In step S**603**, like step S**421**, the system control unit **50** determines whether the currently set focus mode of the digital camera **100** is the AF mode or the MF mode. In a case where the current focus mode is the AF mode (YES in step S**603**), the processing proceeds to step S**604**. In a case where the current focus mode is the MF mode (NO in step S**603**), the processing proceeds to step S**605**. In a case where the currently set focus mode is the MF mode and the focus guide display setting for assisting MF focusing is on, the system control unit **50** superimposes the focus guide on the LV image displayed on the display unit **28**.

(117) In step S**604**, the system control unit **50** moves the AF frame displayed on the display unit **28** in the direction instructed in step S**601**.

(118) In step S**605**, the system control unit **50** moves the focus guide displayed on the display unit **28** in the direction instructed in step S**601**. While the entire focus guide is moved in this process, the frame indicating the focus detection area may be moved instead of the entire focus guide. In a case where the focus guide display setting is set to off by a user setting, this step S**605** is skipped.

(119) In step S**606**, the system control unit **50** moves the zoom frame displayed on the display unit **28** in synchronization with the position of the AF frame or the frame indicating the focus detection area of the focus guide moved in step S**604** or S**605**.

(120) In step S**607**, the system control unit **50** determines whether the directional instruction issued

using the MC **82** or the directional pad **74** and determined in step S**601** is to the right. In a case where the directional instruction is to the right (YES in step S**607**), the processing proceeds to step S**608**. If not (NO in step S**607**), the processing proceeds to step S**611**.

(121) In step S**608**, the system control unit **50** determines whether the x coordinate of the center of the zoom frame before the directional instruction is issued in step S**601** is the coordinate Lmax. In a case where the x coordinate of the center is the coordinate Lmax (YES in step S**608**), the processing proceeds to step S**609**. In a case where the x coordinate of the center is not the coordinate Lmax (NO in step S**608**), the processing proceeds to step S**610**. If the x coordinate of the center of the zoom frame before the directional instruction is issued is Lmax, the right side of the zoom frame touches the line **705** before the input of the directional instruction.

(122) In step S**609**, the system control unit **50** moves the zoom frame to a position where the center of the zoom frame is coordinates (Rmin, the y coordinate before the directional instruction). In other words, in a case where the zoom frame is displayed in the left area with the right side of the zoom frame touching the line **705** and an instruction to move the zoom frame further to the right is input, the zoom frame is moved to the right area. Such control prevents the zoom frame from being displayed over both the left and right areas.

(123) In this step, a dual-lens unit is attached to the digital camera **100** since the determination of step S**602** is YES. Thus, two LV images are displayed on the display unit **28** and displayed in the respective left and right halves of the display unit **28**. In a case where the zoom frame is moved, and if the display position of the zoom frame is controlled and allowed to include both the left and right areas by crossing the line **705** illustrated in FIGS. **7**A and **7**B, an enlarged image including both the left and right LV images is displayed when a zoom instruction is issued by the user, which may confuse the user. Thus, in a case where the zoom frame is moved, and in a case where the left or right side of the zoom frame reaches the border between the left and right areas indicated by the line **705**, the entire zoom frame is displayed in one of the left and right areas so that the zoom frame does not cross the line **705** (not include both the left and right areas).

(124) In step S**610**, the system control unit **50** moves the display position of the zoom frame to the right. Here, the amount of movement by which the display position is moved in response to one directional instruction is one pixel of the display unit **28**. In a case where the right side of the zoom frame reaches the right side of the area **701**R (right end of the display unit **28**) and a movement instruction (directional instruction) to the right is issued, the system control unit **50** does not move the zoom frame.

(125) In step S**611**, the system control unit **50** determines whether the directional instruction issued using the MC **82** or the directional pad **74** and is determined in step S**601** is to the left. In a case where the directional instruction is to the left (YES in step S**611**), the processing proceeds to step S**612**. If not (NO in step S**611**), the processing proceeds to step S**615**.

(126) In step S**612**, the system control unit **50** determines whether the x coordinate of the center of the zoom frame before the directional instruction is issued in step S**601** is the coordinate Rmin. In a case where the x coordinate of the center is the coordinate Rmin (YES in step S**612**), the processing proceeds to step S**613**. In a case where the x coordinate of the center is not the coordinate Rmin (NO in step S**611**), the processing proceeds to step S**614**. In a case where the x coordinate of the center of the zoom frame before the directional instruction is issued is the coordinate Rmin, the left side of the zoom frame touches the line **705** before the input of the directional instruction.

(127) In step S**613**, the system control unit **50** moves the zoom frame to a position where the center of the zoom frame is to coordinates (Lmax, the y coordinate before the directional instruction). In other words, in a case where the zoom frame is displayed in the right area with the left side of the zoom frame touching the line **705**, in response to input of an instruction to movement the zoom frame further to the left, the zoom frame is moved to the left area. Such control prevents the zoom frame from being displayed over both the left and right areas.

(128) In step S**614**, the system control unit **50** moves the display position of the zoom frame to the

left. Here, the amount of movement by which the display position is moved in response to one directional instruction is one pixel of the display unit **28**. In a case where the left side of the zoom frame reaches the left side of the area **701**L (left end of the display unit **28**) and a movement instruction to the left is issued, the system control unit **50** does not move the zoom frame.
(129) In step S**615**, the system control unit **50** determines whether the directional instruction issued using the MC **82** or the directional pad **74** and determined in step S**601** is either up or down. In a case where the directional instruction is up or down (YES in step S**615**), the processing proceeds to step S**616**. In a case where the directional instruction is neither up nor down (NO in step S**615**), the processing proceeds to step S**617**.
(130) In step S**616**, the system control unit **50** moves the display position of the zoom frame in the instructed vertical direction. The amount of movement by which the display position is moved in response to one directional instruction here is one pixel of the display unit **28**.
(131) In a case where, in step S**602**, the system control unit **50** determines that a dual-lens unit is attached to the digital camera **100**, the zoom frame is moved in response to the movement instruction (directional instruction), and the focus guide is not moved from its currently displayed position. That is, the movements performed based on the directional instructions in steps S**609**, S**610**, S**613**, S**614**, and S**616** are only those of the zoom frame, and the focus guide remains unchanged in position (fixed to the center of the LV image in the area where the focus guide is displayed).
(132) The processing procedure about movement control on items, such as the zoom frame and the focus guide, in a case where a directional instruction is input using the MC **82** or the directional pad **74** has been described.
(133) Next, control in a case where an operation for restoring the display positions of items, such as the zoom frame and the focus guide, to their predetermined positions is performed will be described. The system control unit **50** displays the items, such as the zoom frame and the focus guide, at the predetermined positions in response to a predetermined operation (pressing of the MC **82** or the set button **75**). In a case where a dual-lens image is being displayed, the system control unit **50** displays the items at the center of either the right area or the left area where the items are displayed before the predetermined operation in response to the predetermined operation. On the other hand, in a case where a dual-lens image is not being displayed, the system control unit **50** displays the items at the center of the screen in response to the predetermined operation. Thus, the display positions of the items can be appropriately controlled based on determination of whether the displayed image is a dual-lens image.
(134) In step S**617**, the system control unit **50** determines whether either the center of the MC **82** is pressed (instead of the up, down, left, or right movement operation) or the set button **75** is pressed. In a case where the center of the MC **82** or the set button **75** is pressed (YES in step S**617**), the processing proceeds to step S**618**. In a case where neither the center of the MC **82** nor the set button **75** is pressed (NO in step S**617**), the processing proceeds to step S**801** of FIG. **8**A. The pressing of the center of the MC **82** or the set button **75** in this step can be determined as a center movement instruction to move the currently displayed zoom frame to the center of the LV image in the area where the zoom frame is displayed (center return).
(135) In step S**618**, like step S**411**, the system control unit **50** obtains the type of lens unit attached via the communication terminals **6** and **10**, and determines whether the attached lens unit is a dual-lens unit. In a case where the attached lens unit is a dual-lens unit (YES in step S**618**), the processing proceeds to step S**623**. In a case where the attached lens unit is not a dual-lens unit (NO in step S**618**), the processing proceeds to step S**619**.
(136) In step S**619**, like step S**421**, the system control unit **50** determines whether the current focus mode of the digital camera **100** is set to the AF mode or the MF mode. In a case where the current focus mode is set to the AF mode (YES in step S**619**), the processing proceeds to step S**620**. In a case where the current focus mode is set to the MF mode (NO in step S**619**), the processing

proceeds to step S**621**.
(137) In step S**620**, the system control unit **50** moves the AF frame to the center of the LV image displayed on the display unit **28**.
(138) In step S**621**, the system control unit **50** moves the focus guide to the center of the LV image displayed on the display unit **28**.
(139) In step S**622**, the system control unit **50** moves the zoom frame to the center of the LV image displayed on the display unit **28** in synchronization with the position of the AF frame or the focus detection area of the focus guide.
(140) In step S**623**, the system control unit **50** determines whether the zoom frame is displayed on the LV image in the right area. In other words, the system control unit **50** determines whether the zoom frame is displayed in the area **701**R illustrated in FIG. **7**B. In a case where the system control unit **50** determines that the zoom frame is displayed in the area **701**R (YES in step S**623**), the processing proceeds to step S**625**. In a case where the system control unit **50** determines that the zoom frame is not displayed in the area **701**R (NO in step S**623**), the processing proceeds to step S**624**.
(141) In step S**624**, the system control unit **50** moves the display position of the zoom frame to the center of the LV image displayed in the left area. Specifically, the system control unit **50** moves the zoom frame to the center of the LV image displayed in the area **701**L illustrated in FIG. **7**B.
(142) In step S**625**, the system control unit **50** moves the display position of the zoom frame to the center of the LV image displayed in the right area. Specifically, the system control unit **50** moves the zoom frame to the center of the LV image displayed in the area **701**R illustrated in FIG. **7**B.
(143) The processing procedure of the control in the case where an operation for restoring the display positions of items, such as the zoom frame and the focus guide, to their predetermined positions is performed has been described.
(144) Next, zoom processing and zoom ratio change processing to be performed when the zoom button **78** is pressed will be described.
(145) FIGS. **8**A and **8**B are a control flowchart about an operation for enlarging an LV image displayed on the display unit **28** and an imaging operation according to the present exemplary embodiment. Display examples of the display unit **28** when the control flowchart of FIGS. **8**A and **8**B is executed will be described with reference to FIGS. **9**A to **9**F. Details of the display examples illustrated in FIGS. **9**A to **9**F will be described below after the description of the control flowchart of FIGS. **8**A and **8**B.
(146) In step S**801**, the system control unit **50** determines whether the zoom button **78** is pressed. In a case where the zoom button **78** is pressed (YES in step S**801**), the processing proceeds to step S**802**. In a case where the zoom button **78** is not pressed (NO in step S**801**), the processing proceeds to step S**819**. In the present exemplary embodiment, a zoom instruction is issued by a pressing operation performed on the zoom button **78** that is a physical member configured to be pressed down. However, a zoom instruction can also be issued by a pinch-out operation performed on the touch panel **70***a*, and an enlarged display can be cancelled by a pinch-in operation performed on the touch panel **70***a*.
(147) In step S**802**, like step S**411**, the system control unit **50** obtains the type of lens unit attached via the communication terminals **6** and **10**, and determines whether the attached lens unit is a dual-lens unit. In a case where the system control unit **50** determines that the attached lens unit is a dual-lens unit (YES in step S**802**), the processing proceeds to step S**803**. In a case where the system control unit **50** determines that the attached lens unit is not a dual-lens unit (NO in step S**802**), the processing proceeds to step S**812**.
(148) In step S**803**, the system control unit **50** enlarges the LV image at the position where the zoom frame is displayed to six times, and displays the enlarged LV image on the display unit **28**. The size of the zoom frame displayed before the execution of the zoom processing is set in advance so that the enlarged image is entirely displayed on the display unit **28** when the zoom processing is

performed with the zoom ratio of six times. The zoom ratio of six times in this process is determined based on a state where the LV image displayed on the display unit **28** is not enlarged (×1 zoom). FIGS. **9**C and **9**D illustrate enlarged display examples in this process.

(149) In step S**804**, the system control unit **50** determines whether an operation to move a zoom position (enlarged area) is performed. In a case where the operation to move the zoom position is performed (YES in step S**804**), the processing proceeds to step S**805**. In a case where the operation to move the zoom position is not performed (NO in step S**804**), the processing proceeds to step S**806**. The operation to move the zoom position is performed by a directional instruction issued using the MC **82** or the directional pad **74** as described with reference to the control flowchart of FIGS. **6**A and **6**B. The operation can also be performed by an operation performed on the touch panel **70***a*.

(150) In step S**805**, the system control unit **50** moves the zoom position within the currently enlarged one of the left and right of two display areas of the LV images displayed on the display unit **28**, based on the operation for moving the zoom position in step S**804**. In other words, even in a case where the target area of the zoom processing touches the line **705** in either one of the left and right areas and a moving operation to bring the center of the zoom frame closer to the line **705** is performed, the system control unit **50** determines the moving operation to be invalid and does not move the zoom position.

(151) As described in steps S**607** to S**614**, since the user can visually observe the zoom frame displayed on the display unit **28** and the movement of the zoom frame in a state where the LV images is ×1 zoom, the user does not lose track of the zoom frame even in a control where the zoom frame moves from the displayed area to the other. By contrast, the zoom position is moved from one area to the other when an enlarged image is displayed, the user has difficulty in intuitively understanding which position the enlarged image is displaying.

(152) A description will be given by taking an example case where the user wants to observe the left end of the LV image in the right area (the left side of the zoom frame touching the line **705**) in more detail. In a case where the user is observing an enlarged display of the left-end part of the LV image in the right area, and if an operation to move the zoom frame is unintentionally performed by the user and the part to be enlarged and displayed is switched to the right-end part of the LV image in the left area, the user can get confused. Thus, in the state where the enlarged image is displayed, the system control unit **50** does not move the zoom position across the left and right areas in a case where the user issues an instruction to move the zoom position and the zoom position is at the end of the LV image.

(153) In step S**806**, the system control unit **50** determines whether a left-right switch operation is performed. In a case where the left-right switch operation is performed (YES in step S**806**), the processing proceeds to step S**807**. In a case where the left-right switch operation is not performed (NO in step S**806**), the processing proceeds to step S**808**. The left-right switch operation refers to an operation for switching from one of the left and right of the two laterally arranged images to the other. Specifically, the left-right switch operation refers to pressing of a button having a left-right switch function (for example, an info button (not illustrated)).

(154) In step S**807**, the system control unit **50** moves the zoom position from the area where the zoom position is set before the pressing of the button having the left-right switch function to the other area, and provides an enlarged display. In this process, the zoom position is moved in such a manner that the relative position of the zoom position in the area where the zoom position is set before the pressing of the button having the left-right switch function is maintained after the movement to the other area. For example, in a case where the LV image in the right area is being enlarged, the system control unit **50** calculates a distance from the center of the LV image in the right area to the zoom position. In response to the left-right switch operation performed by the user, the system control unit **50** applies the calculated distance from the center of the LV image to the zoom position to a distance from the center of the LV image in the other area (here, left area) to

determine a zoom position and displays the enlarged image on the display unit **28**.
(155) In such control, the user who wants to check the same positions of both the LV images displayed in the left and right areas can easily switch between the left and right LV images with fewer operations. This reduces checking time for imaging.
(156) In step S**808**, the system control unit **50** determines whether the zoom button **78** is pressed.
(157) In a case where the zoom button **78** is pressed (YES in step S**808**), the processing proceeds to step S**809**. In a case where the zoom button **78** is not pressed (NO in step S**808**), the processing proceeds to step S**804**.
(158) In step S**809**, the system control unit **50** refers to the system memory **52**, and determines whether the zoom ratio of the LV image displayed on the display unit **28** is 15 times. In a case where the zoom ratio is 15 times (YES in step S**809**), the processing proceeds to step S**810**. In a case where the zoom ratio is not 15 times (NO in step S**809**), the processing proceeds to step S**811**.
(159) In step S**810**, the system control unit **50** cancels the enlarged state of the LV image, and displays the not-enlarged (×1 zoom) LV images on the display unit **28**. FIGS. **9**A and **9**B illustrate display examples here.
(160) In step S**811**, the system control unit **50** enlarges the LV image at the display position of the zoom frame superimposed on the LV image to a zoom ratio of 15 times, and displays the enlarged image. The zoom ratio of 15 times in this process is determined based on the state where the LV image displayed on the display unit **28** is not enlarged (×1 zoom). FIGS. **9**E and **9**F illustrate display examples here.
(161) In step S**812**, the system control unit **50** enlarges the LV image at the display position of the zoom frame superimposed on the LV image to a zoom ratio of six times, and displays the enlarged image on the display unit **28**. The zoom ratio of six times in this process is determined based on the state where the LV image displayed on the display unit **28** is not enlarged (×1 zoom).
(162) In step S**813**, like step S**804**, the system control unit **50** determines whether an operation to move the zoom position is performed. In a case where the operation to move the zoom position is performed (YES in step S**813**), the processing proceeds to step S**814**. In a case where the operation to move the zoom position is not performed (NO in step S**813**), the processing proceeds to step S**815**.
(163) In step S**814**, the system control unit **50** moves the zoom position within the display area of the LV image based on the operation to move the zoom position. In this step, the lens unit attached to the digital camera **100** is a single-lens unit since the determination of step S**802** is NO. In other words, since only one LV image is displayed on the display unit **28**, the zoom position can be moved without factoring in the determination of whether the area is left or right as in step S**805**.
(164) In step S**815**, like step S**808**, the system control unit **50** determines whether the zoom button **78** is pressed. In a case where the zoom button **78** is pressed (YES in step S**815**), the processing proceeds to step S**816**. In a case where the zoom button **78** is not pressed (NO in step S**815**), the processing returns to step S**813**.
(165) In step S**816**, the system control unit **50** refers to the system memory **52**, and determines whether the current zoom ratio of the LV image is 15 times. In a case where the current zoom ratio is 15 times (YES in step S**816**), the processing proceeds to step S**817**. In a case where the current zoom ratio is not 15 times (NO in step S**816**), the processing proceeds to step S**818**.
(166) In step S**817**, like step S**810**, the system control unit **50** cancels the enlarged state of the LV image, and displays the not-enlarged (×1 zoom) LV image on the display unit **28**.
(167) In step S**818**, the system control unit **50** enlarges the LV image at the display position of the zoom frame superimposed on the LV image to a zoom ratio of 15 times, and displays the enlarged image on the display unit **28**. The zoom ratio of 15 times in this process is determined based on the state where the LV image displayed on the display unit **28** is not enlarged (×1 zoom).
(168) In step S**819**, the system control unit **50** determines whether the first shutter switch **62** is on. In a case where the first shutter switch **62** is on (YES in step S**819**), the processing proceeds to step

S**820**. In a case where the first shutter switch **62** is not on (NO in step S**819**), the processing proceeds to step S**829**. That the first shutter switch **62** being on refers to the state where the shutter button **61** is half-pressed as described above. In other words, it can be determined that the user is about to perform image capturing.

(169) In step S**820**, like step S**411**, the system control unit **50** obtains the type of lens unit attached via the communication terminals **6** and **10**, and determines whether the attached lens unit is a dual-lens unit. In a case where the system control unit **50** determines that the attached lens unit is a dual-lens unit (YES in step S**820**), the processing proceeds to step S**823**. In a case where the system control unit **50** determines that the attached lens unit is not a dual-lens unit (NO in step S**820**), the processing proceeds to step S**821**.

(170) In step S**821**, the system control unit **50** determines whether the focus mode is set to the AF mode. In a case where the focus mode is set to the AF mode (YES in step S**821**), the processing proceeds to step S**822**. In a case where the focus mode is not set to the AF mode (the focus mode is set to the MF mode) (NO in step S**821**), the processing proceeds to step S**823**. The AF mode and the MF mode are switched via a setting menu screen or by using a switch provided outside the lens unit **150**.

(171) In step S**822**, the system control unit **50** performs AF processing based on the position of the AF frame.

(172) In step S**823**, the system control unit **50** performs other imaging preparation processing including AE and AWB processing.

(173) In step S**824**, the system control unit **50** determines whether the second shutter switch **64** is on. In a case where the second shutter switch **64** is on, i.e., the shutter button **61** is fully pressed (YES in step S**824**), the processing proceeds to step S**825**. In a case where the second shutter switch **64** is not on (NO in step S**824**), the processing proceeds to step S**828**.

(174) In step S**825**, like step S**411**, the system control unit **50** obtains the type of lens unit attached via the communication terminals **6** and **10**, and determines whether the attached lens unit is a dual-lens unit. In a case where the system control unit **50** determines that the attached lens unit is a dual-lens unit (YES in step S**825**), the processing proceeds to step S**826**. In a case where the system control unit **50** determines that the attached lens unit is not a dual-lens unit (NO in step S**825**), the processing proceeds to step S**827**.

(175) In step S**826**, the system control unit **50** performs a series of imaging processes up to recording of an image captured by the dual-lens unit and dual-lens information on the recording medium **200** as an image file.

(176) In step S**827**, the system control unit **50** performs a series of imaging processes up to recording of a captured image and normal (single) lens information on the recording medium **200** as an image file.

(177) In step S**828**, the system control unit **50** determines whether the first shutter switch **62** remains on. In a case where the system control unit **50** determines that the first shutter switch **62** remains on (YES in step S**828**), the processing returns to step S**824**. If not (NO in step S**828**), the processing proceeds to step S**829**.

(178) In step S**829**, the system control unit **50** determines whether any operation other than the foregoing operation is detected. In a case where any other operation is detected (YES in step S**829**), the processing proceeds to step S**830**. In a case where any other operation is not detected (NO in step S**829**), the processing proceeds to step S**831**. Specifically, the system control unit **50** determines whether the menu button **81** or the playback button **79** is pressed.

(179) In step S**830**, the system control unit **50** starts to perform processing corresponding to the detected operation. In a case where the menu button **81** is pressed, the system control unit **50** displays the menu screen for settings. In a case where the playback button **79** is pressed, the system control unit **50** displays an image stored in the recording medium **200**.

(180) In step S**831**, the system control unit **50** determines whether the imaging standby state is

ended. For example, in a case where the imaging standby state is ended by power-off (YES in step S**831**), the control flowchart of FIGS. **8**A and **8**B ends. In a case where the system control unit **50** determines that the imaging standby state is not ended (NO in step S**831**), the processing returns to step S**401** of FIG. **4**.

(181) The LV images displayed on the display unit **28** when a zoom instruction is issued by the user will be described with reference to FIGS. **9**A to **9**F.

(182) FIG. **9**A illustrates a display example where the enlargement ratio is ×1 (i.e., without zoom) and the zoom frame **903** is superimposed on the left area, i.e., an LV image (LV **900**R) captured via the right-eye optical system **301**R. The display unit **28** displays the LV **900**R captured via the right-eye optical system **301**R and an LV **900**L captured via the left-eye optical system **301**L. As described above, the LV **900**R displayed in the left area is an LV image captured via the right-eye optical system **301**R, and the LV **900**L displayed in the right area is an LV image captured via the left-eye optical system **301**L.

(183) Display items **901** and **902** are displayed to notify the user of the lateral inversion. The display item **901** displays "R", which indicates the right. The display item **902** displays "L", which indicates the left. In a case where the zoom button **78** is pressed once in the state illustrated in FIG. **9**A, the state transitions to that illustrated in FIG. **9**C. In a case where the left-right switch button (not illustrated) is pressed once, the state transitions to that illustrated in FIG. **9**B, where the zoom frame **903** superimposed on the LV **900**R is moved to a relatively similar position in the LV **900**L as a zoom frame **904**.

(184) FIG. **9**B illustrates a display example where the zoom ratio is ×1 (i.e., without zoom) and the zoom frame **904** is superimposed on the right area, i.e., the LV image (LV **900**L) captured by the left-eye optical system **301**L. In FIG. **9**B, a zoom frame **904** is superimposed on the LV **900**L. In a case where the zoom button **78** is pressed once in the state illustrated FIG. **9**B, the state transitions to that illustrated in FIG. **9**D. In a case where the left-right switch button is pressed once, the state transitions to that illustrated in FIG. **9**A, where the zoom frame **904** superimposed on the LV **900**L is moved to a relatively similar position in the LV **900**R as the zoom frame **903**.

(185) FIG. **9**C illustrates a display example where the LV **900**R is enlarged to the zoom ratio of six times. The display item **901** indicating which optical system the enlarged image displayed on the display unit **28** is captured by is superimposed on an LV **910**R that is the enlarged LV image. Additionally, the zoom frame **913** is superimposed on the six times enlarged image.

(186) FIG. **9**D illustrates a display example where the LV **900**L is enlarged to a zoom ratio of six times. The display item **902** indicating which optical system the enlarged image displayed on the display unit **28** is captured by is superimposed on an LV **910**L that is the enlarged LV image. Additionally, the zoom frame **914** is superimposed on the six times enlarged image.

(187) FIG. **9**E illustrates a display example where the LV **900**R is enlarged to a zoom ratio of 15 times and displayed as an LV **920**R.

(188) The display item **901** indicating an LV image captured by the right-eye optical system **301**R is superimposed on the LV **920**R that is the 15 times enlarged image and displayed on the display unit **28**.

(189) FIG. **9**F illustrates a display example where the LV **900**L is enlarged to a zoom ratio of 15 times and displayed as an LV **920**L.

(190) The display item **902** indicating an LV image captured by the left-eye optical system **301**L is superimposed on the LV **920**L that is the 15 times enlarged image and displayed on the display unit **28**.

(191) In other words, FIGS. **9**A and **9**B illustrate the LV images, displayed on the display unit **28**, of a case where the zoom ratio is ×1 (i.e., without zoom), FIGS. **9**C and **9**D illustrate the LV images, displayed on the display unit **28**, of a case where the zoom ratio is ×6, and FIGS. **9**E and **9**F illustrate the LV images, displayed on the display unit **28**, of a case where the zoom ratio is ×15.

(192) The zoom ratio of the LV image(s) displayed on the display unit **28** is changed in order of ×1,

×6, ×5, and ×1 each time the zoom button **78** is pressed. In a case where the left-right switch button is pressed and the zoom ratio is ×1, the display area is switched so that the zoom frame is superimposed on the other LV image. Specifically, in a case where the zoom frame is superimposed on the LV **900**R displayed in the left area, the display area is switched so that the zoom frame is superimposed on the LV **900**L displayed in the right area. In a case where the zoom ratio is other than ×1, the zoom position is switched to the area of the other LV image at a relatively similar position. Here, the zoom ratio is maintained unchanged.

(193) In the above descriptions, the operations for issuing instructions to switch the display mode, instructions to move the zoom frame or zoom position, and zoom instructions are performed by using the operation buttons having the dedicated functions. Alternatively, the functions may be assigned to a button or buttons to which various functions can be freely assigned.

(194) As described above, when an image is captured with a lens unit including two optical systems (dual-lens unit) attached, the zoom frame indicating the zoom position of the LV images is prevented from being displayed over the border between the two LV images during imaging. The two LV images captured via the two optical systems are displayed on the display unit **28** side by side, and the zoom frame is not displayed over or moved across the border between the two LV images. This can prevent an image including both the two LV images from being enlarged and displayed when the user issues a zoom instruction, whereby the user's confusion can be reduced.

(195) In a case where the two LV images are displayed at ×1 zoom (not enlarged), in response to a movement instruction further to the right issued from the user in a state where the zoom frame reaches the right end of the LV image displayed in the left area, the zoom frame is moved to skip the border between the two LV images.

(196) More specifically, the zoom frame is controlled to move from the right end of the LV image in the left area to the left end of the LV image in the right image. This can prevent the area indicated by the zoom frame from including both the two LV images, and can smoothly move the zoom frame between the two LV images.

(197) On the other hand, in a case where either one of the two LV images is enlarged, the zoom frame is not moved in the instructed direction even if a movement instruction for the zoom position is further performed on the zoom frame reached the border-side end of the currently enlarged image (the right end of a case where the left area is enlarged or the left end of a case where the right area is enlarged). In other words, in situations where the user has difficulty in visually observing the current zoom position, the zoom position is not moved beyond the area (border between the LV images). This can prevent unintended crossing of the border between the LV images, and can reduce the user's confusion.

(198) In a case where a lens unit including two optical systems (dual-lens unit) is attached, the focus guide and the zoom frame are not in synchronization with each other (not synchronized). When two LV images are displayed like a case where a dual-lens unit is attached, and details of the entire LV images are difficult to observe without enlarging the LV images, the user is likely to want to enlarge the LV images and check the LV images in more detail regardless of the in-focus position. Thus, the focus guide and the zoom frame are not synchronized with each other so that the user can zoom in on not only the position of the focus guide including the frame indicating the focus detection position but desired positions as well. On the other hand, in a case where a normal lens unit (single-lens unit) is attached, the focus guide or AF frame and the zoom frame are basically in synchronization with each other so that the position of the zoom frame also moves as the focus guide or the AF frame is moved. Since, in a case where a single-lens unit is attached, only one LV image is displayed on the display unit **28** in a larger size than when two LV images are displayed, the user can easily observe details of the LV image in ×1 zoom compared to the LV image of a case where a dual-lens unit is attached.

(199) The foregoing various controls that are performed by the system control unit **50** may be performed by a single piece of hardware. A plurality of pieces of hardware (such as a plurality of

processors or circuits) may share the processing to perform entire control of the entire digital camera **100**.

(200) While the exemplary embodiment of the present invention has been described in detail, the present invention is not limited to this specific exemplary embodiment, and various variations within a range not departing from the gist of the invention are also included in the present invention. Moreover, the foregoing exemplary embodiment is just one exemplary embodiment of the present invention, and various exemplary embodiments can be combined as appropriate.

(201) The foregoing exemplary embodiment has been described by using an example where the exemplary embodiment is applied to the digital camera **100**. However, this example is not restrictive, and an exemplary embodiment of the present invention is applicable to any electronic equipment that can display an image captured using two optical systems. More specifically, an exemplary embodiment of the present invention can be applied to a personal computer, a personal digital assistant (PDA), a mobile phone terminal, a portable image viewer, a printer apparatus including a display, a digital photo frame, a music player, a game machine, an electronic book reader, home appliances, an on-vehicle apparatus, and a medical device.

(202) An exemplary embodiment of the present invention is not limited to the imaging apparatus main body but also applicable to electronic equipment that communicates with an imaging apparatus (such as a network camera) via wired or wireless communication and remotely control the imaging apparatus. Examples of the apparatus that remotely controls an imaging apparatus include a smartphone, a tablet personal computer (PC), and a desktop PC. The imaging apparatus can be remotely controlled by the electronic equipment notifying the imaging apparatus of commands for various operations and settings based on operations performed on the control apparatus or processing performed by the electronic equipment. The electronic equipment may be able to receive LV images captured by the imaging apparatus via wired or wireless communication and display the LV images.

Other Embodiments

(203) Embodiment(s) of the present invention 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.

(204) According to an exemplary embodiment of the present invention, the user can visually observe a zoom position in a state where a plurality of LV images obtained via a plurality of optical systems is displayed.

(205) While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention 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.

## Claims

1. An image capturing apparatus capable of attaching/detaching a lens unit, comprising: a processor; and a memory storing a program which, when executed by the processor, causes the image capturing apparatus to: obtain a third image in which a first image captured via a first optical system and a second image captured via a second optical system are arranged side by side, wherein the second image has parallax with the first image, when a dual-lens unit including the first optical system and the second optical system is attached; obtain a fourth image captured via a single optical system, when a single lens unit including the single optical system is attached; perform display control to display an item indicating a focus detection area on a screen of a display unit; receive a position designation for designating a position of the item on the screen, based on detecting a user operation; and perform display control to move and display the item on the screen based on the position designation, wherein the item is displayed and superimposed at a predetermined position of either one of the first image and the second image on the screen upon receiving the position designation when the dual-lens unit is attached, and the item is displayed and superimposed at a position corresponding to the position designation on the screen upon receiving the position designation when the single lens unit is attached.
2. The apparatus according to claim 1, wherein the item indicates a degree of in-focus at the focus detection area.
3. The apparatus according to claim 1, wherein the predetermined position is a center position.
4. The apparatus according to claim 1, wherein the program when executed by the processor further causes the image capturing apparatus to perform enlargement processing on a target area; perform display control to display a zoom frame indicating the target area on the screen; receive a zoom position designation for designating a position of the zoom frame on the screen, based on detecting a user operation; and perform display control to move and display the zoom frame on the screen based on the zoom position designation; wherein the item is displayed without moving in a manner linked with the zoom frame when the dual-lens unit is attached, and the item is moved and displayed in a manner linked with the zoom frame when the single lens unit is attached.
5. The apparatus according to claim 1, when executed by the processor further causes the image capturing apparatus to perform display control to display a magic window indicating an area to be initially displayed on an external display device, when the dual-lens unit is attached.
6. The apparatus according to claim 5, wherein the magic window is displayed and superimposed on both the first image and the second image on the screen.
7. A method for controlling an image capturing apparatus capable of attaching/detaching a lens unit, comprising: obtaining a third image in which a first image captured via a first optical system and a second image captured via a second optical system are arranged side by side, wherein the second image has parallax with the first image, when a dual-lens unit including the first optical system and the second optical system is attached; obtaining a fourth image captured via a single optical system, when a single lens unit including the single optical system is attached; performing display control to display an item indicating a focus detection area on a screen of a display unit; receiving a position designation for designating a position of the item on the screen, based on detecting a user operation; and performing display control to move and display the item on the screen based on the position designation, wherein the item is displayed and superimposed at a predetermined position of either one of the first image and the second image on the screen upon receiving the position designation when the dual-lens unit is attached, and the item is displayed and superimposed at a position corresponding to the position designation on the screen upon receiving the position designation when the single lens unit is attached.

8. The method according to claim 7, wherein the item indicates a degree of in-focus at the focus detection area.
9. The method according to claim 7, wherein the predetermined position is a center position.
10. The method according to claim 7, further comprising: performing enlargement processing on a target area; performing display control to display a zoom frame indicating the target area on the screen; receiving a zoom position designation for designating a position of the zoom frame on the screen, based on detecting a user operation; and performing display control to move and display the zoom frame on the screen based on the zoom position designation; wherein the item is displayed without moving in a manner linked with the zoom frame when the dual-lens unit is attached, and the item is moved and displayed in a manner linked with the zoom frame when the single lens unit is attached.
11. The method according to claim 7, when executed by the processor further causes the image capturing apparatus to perform display control to display a magic window indicating an area to be initially displayed on an external display device, when the dual-lens unit is attached.
12. The method according to claim 11, wherein the magic window is displayed and superimposed on both the first image and the second image on the screen.
13. A non-transitory computer-readable recording medium storing a program for causing the image capturing apparatus to execute the method according to claim 7.
14. The non-transitory computer-readable recording medium according to claim 13, wherein the item indicates a degree of in-focus at the focus detection area.
15. The non-transitory computer-readable recording medium according to claim 13, wherein the predetermined position is a center position.
16. The non-transitory computer-readable recording medium according to claim 13, further comprising: performing enlargement processing on a target area; performing display control to display a zoom frame indicating the target area on the screen; receiving a zoom position designation for designating a position of the zoom frame on the screen, based on detecting a user operation; and performing display control to move and display the zoom frame on the screen based on the zoom position designation; wherein the item is displayed without moving in a manner linked with the zoom frame when the dual-lens unit is attached, and the item is moved and displayed in a manner linked with the zoom frame when the single lens unit is attached.
17. The non-transitory computer-readable recording medium according to claim 13, when executed by the processor further causes the image capturing apparatus to perform display control to display a magic window indicating an area to be initially displayed on an external display device, when the dual-lens unit is attached.
18. The non-transitory computer-readable recording medium according to claim 17, wherein the magic window is displayed and superimposed on both the first image and the second image on the screen.