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Electronic apparatus, method of controlling the same, and computer-readable storage medium storing program

Abstract

An electronic apparatus including a plurality of lenses acquires a first captured image captured using a first lens, acquires a second captured image captured using a second lens, acquires a third captured image captured using a third lens, superimposes the second captured image on the first captured image, detects an object from the first captured image, generates a combined image where the second captured image is superimposed on the first captured image in a case where a region of the detected does not overlap with a region where the second captured image is superimposed, and generates a combined image where the second captured image is superimposed on the third captured image in a case where the region of the detected object overlaps with the region where the second captured image is superimposed.

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References Cited

U.S. PATENT DOCUMENTS

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2017/0094189	12/2016	Ogawa	N/A	H04N 23/667

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
2009188800	12/2008	JP	N/A
2015043557	12/2014	JP	N/A

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Background/Summary

BACKGROUND

Field

(1) The present disclosure relates to an electronic apparatus, a method of controlling the electronic apparatus, and a computer-readable storage medium storing a program.

Description of the Related Art

(2) There is an imaging method of superimposing and combining one of a plurality of captured images with another captured image and outputting a resultant image (picture-in-picture, hereinafter, also referred to as PIP). PIP imaging is used for still image capturing as well as for various scenes such as distribution of a moving image or a live video, video display in a web conference, and television video.

(3) In recent years, development of a smartphone has progressed, and most smartphones include a camera including a plurality of lenses different in angle of view such as a wide-angle lens, a standard lens, and a telephoto lens. Some smartphones have, as a camera function, a function of displaying/recording captured images by the plurality of lenses in a PIP mode.

(4) When imaging/display in the PIP mode is performed using an electronic apparatus represented by the smartphone, display of an object in a captured image and display of a captured image to be superimposed (hereinafter, also referred to as PIP window) overlap with each other to deteriorate

visibility in some cases.
(5) Japanese Patent Application Laid-Open No. 2009-188800 discusses an image display apparatus that detects an object and moves a position of the PIP window when the object is moved toward the PIP window.
(6) In Japanese Patent Application Laid-Open No. 2009-188800, however, the PIP window may overlap with the object even after the PIP window is moved. For example, as discussed in Japanese Patent Application Laid-Open No. 2015-043557, a zoom magnification is changed and an angle of view is narrowed to largely image an object in some cases. In such a case, even after the PIP window is moved, the PIP window can possibly overlap with the object, which could result in some deterioration in visibility of the object.
(7) For example, in a case where a photographer performs live distribution, the photographer hosts a distribution program and operates a camera or a smartphone used for distribution as well. The photographer checks a captured state of the object and the PIP window point by point, and if the object and the PIP window overlap with each other, it is necessary for the photographer to suspend recording or distribution of the moving image and to change an angle of view and a position of the camera. For this reason, the photographer cannot concentrate on imaging/distribution (e.g., host of distribution program).
SUMMARY
(8) Aspects of the present disclosure are directed to, in a case where imaging is performed by an electronic apparatus including a plurality of lenses different in angle of view, and a captured image obtained using one lens is superimposed on a captured image obtained using another lens, a technique to prevent the captured image to be superimposed from overlapping with an object included in the other captured image.
(9) An electronic apparatus includes a plurality of lenses, each having different angles of view, a processor, and a memory storing a program which, when executed by the processor, causes the electronic apparatus to acquire a first captured image captured using a first lens from among the plurality of lenses, acquire a second captured image captured using a second lens from among the plurality of lenses, wherein the second lens is different from the first lens, acquire a third captured image captured using a third lens from among the plurality of lenses, wherein the third lens is wider in angle of view than the first lens, superimpose the second captured image on the first captured image, detect an object from the first captured image, generate a combined image where the second captured image is superimposed on the first captured image in a case where a region of the detected object does not overlap with a region where the second captured image is superimposed, and generate a combined image where the second captured image is superimposed on the third captured image in a case where the region of the detected object overlaps with the region where the second captured image is superimposed.
(10) Further features 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 diagrams of a smartphone.
(2) FIG. **2** is a block diagram illustrating a configuration of the smartphone.
(3) FIGS. **3**A to **3**C are diagrams illustrating issues that can be overcome according to an exemplary embodiment.
(4) FIG. **4** is a flowchart illustrating control processing according to an exemplary embodiment.
(5) FIG. **5** is a flowchart illustrating object detection/display change processing according to the exemplary embodiment.

(6) FIGS. **6**A and **6**B are diagrams respectively illustrating a moving image capturing/recording screen and an image display setting screen.
(7) FIGS. **7**A and **7**B are diagrams each illustrating relationship between an object and a display region of a picture-in-picture (PIP) window.

DESCRIPTION OF THE EMBODIMENTS

(8) An exemplary embodiment will be described with reference to drawings. In the present exemplary embodiment, a smartphone is described as an example of an electronic apparatus.
(9) FIGS. **1**A and **1**B are diagrams of a smartphone **100**. FIG. **1**A is a front view of the smartphone **100** and FIG. **1**B is a rear view of the smartphone **100**.
(10) The smartphone **100** includes a display **105**, rear camera **114**, and front camera **115**.
(11) The display **105** is a display unit provided on a front surface of the smartphone **100** and configured to display an image and various kinds of information. The smartphone can display a live-view image (LV) image captured by the rear camera **114** or the front camera **115** on the display **105**. The rear camera **114** includes a rear telephoto camera **114***a*, a rear standard camera **114***b*, and a rear super wide-angle camera **114***c*. The front camera **115** includes a front standard camera **115***a* and a front super wide-angle camera **115***b*.
(12) The smartphone **100** includes an operation unit **106**. The operation unit **106** includes a touch panel **106***a*, a power button **106***b*, a volume plus button **106***c*, a volume minus button **106***d*, and a home button **106***e*.
(13) The touch panel **106***a* is a touch operation member and can detect touch operation on a display surface (operation surface) of the display **105**. The power button **106***b* is an operation member, and can switch lighting on/off of the display **105**. When the power button **106***b* is continuously depressed (depressed long) for a certain time, for example, for three seconds, the smartphone **100** can be switched on or off. The volume plus button **106***c* and the volume minus button **106***d* are volume buttons for controlling volume of sound output from a sound output unit **112** described below. When the volume plus button **106***c* is depressed, the volume is turned up, and when the volume minus button **106***d* is depressed, the volume is turned down. In an imaging standby state during use of the camera, the volume plus button **106***c* and the volume minus button **106***d* function as a shutter button for instructing imaging in response to depression. A user can perform optional setting such that a specific function is executed in a case where the power button **106***b* and the volume minus button **106***d* are simultaneously depressed or in a case where the volume minus button **106***d* is quickly depressed several times.
(14) The home button **106***e* is an operation button to display, on the display **105**, a home screen that is a startup screen of the smartphone **100**. When the home button **106***e* is depressed while various applications are started up and used in the smartphone **100**, the various applications can be temporarily closed and the home screen can be displayed. The home button **106***e* is assumed to be a physically-depressible button. The home button **106***e* may not be a physical button, and can be a touchable button that has a similar function and is displayed on the display **105**.
(15) The smartphone **100** includes a sound output terminal **112***a* and a speaker **112***b*. The sound output terminal **112***a* is an earphone jack, and outputs sound to an earphone, an external speaker, or the like. The speaker **112***b* is a built-in speaker outputting sound. In a case where sound is output from the smartphone **100** while a terminal outputting the sound, for example, an earphone cord is not attached to the sound output terminal **112***a*, the sound is output from the speaker **112***b*.
(16) FIG. **2** is a block diagram illustrating a configuration example of the smartphone **100**. In FIG. **2**, components that are the same as the components in FIGS. **1**A and **1**B are denoted by the same reference numerals.
(17) In the smartphone **100**, a central processing unit (CPU) **101**, a memory **102**, a nonvolatile memory **103**, a rear camera image processing unit **104**, the display **105**, the operation unit **106**, a recording medium interface (I/F) **107**, an external I/F **109**, and a communication I/F **110** are connected to an internal bus **150**.

(18) In the smartphone **100**, the sound output unit **112**, an attitude detection unit **113**, the rear camera **114**, the front camera **115**, and an camera image processing unit **116** are also connected to the internal bus **150**. The units connected to the internal bus **150** can mutually exchange data via the internal bus **150**.
(19) The CPU **101** is a control unit for controlling the smartphone **100** and includes at least one processor or circuit. The memory **102** includes, for example, a random access memory (RAM such as volatile memory using semiconductor device). The CPU **101** controls each of the units in the smartphone **100** using the memory **102** as a work memory based on programs stored in, for example, the nonvolatile memory **103**. The nonvolatile memory **103** stores image data, sound data, other data, various kinds of programs for operation of the CPU **101**, and the like. The nonvolatile memory **103** includes, for example, a flash memory or a read only memory (ROM).
(20) The rear camera image processing unit **104** performs various kinds of image processing and object recognition processing on an image captured by the rear camera **114** under the control of the CPU **101**. A rear telephoto camera image processing unit **104***a*, a rear standard camera image processing unit **104***b*, and a rear super wide-angle camera image processing unit **104***c* are respectively provided for the rear telephoto camera **114***a*, the rear standard camera **114***b*, and the rear super wide-angle camera **114***c*. Each of the image processing units performs processing on an image captured by the corresponding camera. In the present exemplary embodiment, each of the three rear cameras has a respective image processing unit. The image processing units are not necessarily individually provided for the three rear cameras. Any two of the three rear cameras can share one image processing unit, or the three rear cameras can share one image processing unit.
(21) The front camera image processing unit **116** performs various kinds of processing and object recognition processing on an image captured by the front camera **115**. Each of the image processing units can also perform various kinds of image processing on an image stored in the nonvolatile memory **103** or a recording medium **108**, a video signal acquired through the external I/F **109**, an image acquired via the communication I/F **110**, and the like. The image processing performed by each of the image processing units includes an analog-to-digital (A/D) conversion processing, digital-to-analog (D/A) conversion processing, encoding processing, compression processing, decoding processing, enlargement/reduction processing (resizing processing), noise reduction processing, color conversion processing, and the like of image data. Each of the image processing units can include a dedicated circuit block performing specific image processing. The rear camera image processing unit **104** can be united as one processing block, and can exclusively process images of the respective cameras by using parallel processing or time-division processing. Depending on a type of image processing, the CPU **101** can perform the image processing based on the programs without using the image processing units.
(22) The display **105** displays an image, a graphical user interface (GUI) screen configuring a GUI, and the like under the control of the CPU **101**. The CPU **101** controls the units of the smartphone **100** to generate a display control signal, to generate a video signal to be displayed on the display **105**, and to output the video signal to the display **105**, based on the programs. The display **105** displays a video based on the output video signal. The smartphone **100** itself can include an interface to output the video signal to be displayed on the display **105**, and the display **105** can be an external monitor (e.g., television).
(23) The operation unit **106** is an input device receiving user operation, and includes a character information input device such as a keyboard, a pointing device such as a mouse and a touch panel, buttons, a dial, a joystick, a touch sensor, and a touch pad. The touch panel is an input device that is planarly superimposed on the display **105** and outputs coordinate information on a touch position. The operation unit **106** includes the touch panel **106***a*, the power button **106***b*, the volume plus button **106***c*, the volume minus button **106***d*, and the home button **106***e* described above.
(24) The recording medium **108** such as a memory card, a compact disc (CD), and a digital versatile disc (DVD) can be connected to the recording medium I/F **107**. The recording medium I/F

107 reads out data from the connected recording medium **108** and writes data in the connected recording medium **108** under the control of the CPU **101**. The recording medium **108** can be a built-in storage incorporated in the smartphone **100**. The external I/F **109** is an interface that is connected to an external apparatus by a wired cable or radio and performs input/output of the video signal and the sound signal. The communication I/F **110** is an interface that communicates with the external apparatus, the Internet **111**, and the like and transmits/receives various kinds of data such as a file and a command.

(25) The sound output unit **112** outputs sound of a moving image and music data, operation sound, ringtone, various kinds of notification sound, and the like. The sound output unit **112** includes the sound output terminal **112***a* for connection of an earphone, and the speaker **112***b*, but sound can be output by wireless communication or the like.

(26) The attitude detection unit **113** detects an attitude of the smartphone **100** in a gravity direction, and inclination of the attitude to axes of yaw, roll, and pitch. It is possible to determine whether the smartphone **100** is horizontally held, vertically held, directed upward, directed downward, inclined, or the like based on the attitude detected by the attitude detection unit **113**. At least one of an acceleration sensor, a gyro sensor, a geomagnetic sensor, an azimuth sensor, or an altitude sensor can be used, or a plurality of sensors can be used in combination as the attitude detection unit **113**.

(27) The rear camera **114** is a camera disposed on a surface on a side opposite the display **105** in a housing of the smartphone **100**. A focal length of the rear telephoto camera **114***a* is longer than a focal length of the rear standard camera **114***b*, and the rear telephoto camera **114***a* can perform imaging on a telephoto side compared with the rear standard camera **114***b*. A focal length of the rear super wide-angle camera **114***c* is shorter than the focal length of the rear standard camera **114***b*, and the rear super wide-angle camera **114***c* can perform imaging at a wide angle compared with the rear standard camera **114***b*. In other words, the focal length is shorter and the angle of view becomes greater in order of the rear telephoto camera **114***a*, the rear standard camera **114***b*, and the rear super wide-angle camera **114***c*. In the present exemplary embodiment, it is assumed that the rear telephoto camera **114***a* includes a lens of a mechanism optically zoomed to a predetermined magnification, but the rear telephoto camera **114***a* can include a lens of a mechanism with a magnification variable by the user. The front camera **115** is a camera disposed on the surface provided with the display **105** in the housing of the smartphone **100**. A focal length of the front super wide-angle camera **115***b* is shorter than a focal length of the front standard camera **115***a*, and the front super wide-angle camera **115***a* can perform imaging at a wide angle as compared with the front standard camera **115***a*.

(28) The rear telephoto camera **114***a*, the rear standard camera **114***b*, and the rear super wide-angle camera **114***c* can perform imaging operation at the same time. All of the three cameras do not necessarily perform the imaging operation at the same time. Any two of the three cameras can perform the imaging operation, or one of the three cameras can perform the imaging operation. Any of the LV images captured by the rear camera **114** and the front camera **115** can be displayed on the display **105**. The camera to capture the image to be displayed on the display **105** can be selected by operation of the touch panel **106***a*. In other words, when the rear telephoto camera **114***a* is selected, an image enlarged more than an image by the rear standard camera **114***b* can be displayed on the display **105**. When the rear standard camera **114***b* is selected, an image that is wider in angle of view than an image by the rear telephoto camera **114***a* and is enlarged more than an image by the rear super wide-angle camera **114***c* can be displayed. When the rear super wide-angle camera **114***c* is selected, an image wider in angle of view than both of the image by the rear telephoto camera **114***a* and the image by the rear standard camera **114***b* can be displayed. Alternatively, the photographer can select either imaging what the photographer sees or the photographer, depending on whether the rear camera **114** or the front camera **115** is used.

(29) The operation unit **106** includes the touch panel **106***a*. The CPU **101** can detect the following operation on the touch panel **106***a* or states: operation where a user's finger or a stylus that has not

been in touch with the touch panel **106***a* newly touches the touch panel **106***a*, i.e., start of touch (hereinafter, referred to as "touch-down"). state where a user's finger or a stylus is in touch with the touch panel **106***a* (hereinafter, referred to as "touch-on"). operation where a user's finger or a stylus moves while being in touch with the touch panel **106***a* (hereinafter, referred to as "touch-move"). operation where a user's finger or a stylus that has been in touch with the touch panel **106***a* is removed from the touch panel **106***a*, i.e., end of touch (hereinafter, referred to as "touch-up"). state where nothing is in touch with the touch panel **106***a* (hereinafter, referred to as "touch-off").
(30) When "touch-down" is detected, "touch-on" is also detected at the same time. Unless "touch-up" is detected after "touch-down", "touch-on" is normally continuously detected. When "touch-move" is detected, "touch-on" is also detected at the same time. When "touch-on" is detected but a touch position is not moved, "touch-move" is not detected. When "touch-up" of all of the user's fingers or the stylus that have been in touch with the touch panel **106***a* is detected, "touch-off" is detected.
(31) The CPU **101** is notified of the operation/states and a coordinate of a position where the user's finger or the stylus is contacting the touch panel **106***a* via the internal bus **150**. The CPU **101** determines what kind of operation (touch operation) has been performed on the touch panel **106***a* based on the information received by the CPU **101**.
(32) With respect to "touch-move", a moving direction of the user's finger or the stylus moving on the touch panel **106***a* can also be determined for a perpendicular component and a horizontal component on the touch panel **106***a* based on change in positional coordinate(s). In a case where "touch-move" of a predetermined distance or more is detected, it is determined that a slide operation has been performed. An operation where a user's finger is swiftly moved a certain distance across the touch panel **106***a* while the user's finger or stylus is contacting the touch panel **106***a* and the user's finger or stylus is then removed from the touch panel **106***a* is referred to as a "flick". In other words, the "flick" is operation of swiftly moving the user's finger or stylus over the touch panel **106***a* like a flip. When "touch-move" at a predetermined speed or more by a predetermined distance or more is detected, and then "touch-up" is detected, it can be determined that a flick operation has been performed (it can be determined that a flick operation has been performed subsequent to a slide operation). A touch operation of simultaneously touching a plurality of positions (e.g., two points) and bringing the touch positions close to each other is referred to as "pinch-in", and touch operation of moving the touch positions away from each other is referred to as "pinch-out". "Pinch-out" and "pinch-in" are collectively referred to as a pinch operation (or simply referred to as "pinch"). The touch panel **106***a* can be any type of a touch panel, such as a resistive film type, an electrostatic capacitance type, a surface acoustic wave type, an infrared-ray type, an electromagnetic induction type, an image recognition type, or an optical sensor type. While the above-description refers to a touch panel where detection that a touch operation has been performed is based on contact on the touch panel, any type of touch panel is applicable, such as a touch panel where detection that a touch operation has been performed is based on a proximity of the user's finger or stylus to the touch panel.
(33) In the present exemplary embodiment, processing to display an object and a picture-in-picture (PIP) window and angle-of-view change processing at the moving image capturing/distribution by the smartphone **100** are described.
(34) FIGS. **3**A to **3**C are diagrams illustrating issues to be solved by the present exemplary embodiment.
(35) FIG. **3**A illustrates, as an example of moving image recording or moving image distribution, a state where a photographer **301** images a facial expression of the photographer **301** using the front standard camera **115***a* of the smartphone **100** while imaging an object **302** using the rear telephoto camera **114***a*. It is assumed that the photographer **301** performs PIP imaging by superimposing an LV image acquired by the front standard camera **115***a* on an LV image acquired by the rear telephoto camera **114***a*.

(36) The PIP imaging is not limited to a combination of the rear telephoto camera **114***a* and the front standard camera **115***a*, and can use any combination of the cameras of the rear camera **114** and the front camera **115**.
(37) FIG. **3**B is a diagram illustrating an image displayed on the display **105** of the smartphone **100** in the imaging described with reference to FIG. **3**A. An LV image **304** acquired by the front standard camera **115***a* is displayed in a PIP window on the display **105** by being superimposed on an LV image **303** acquired by the rear telephoto camera **114***a*. In FIG. **3**B, the object **302** in the LV image **303** and the LV image **304** partially overlap each other, and the object **302** is partially hidden. Accordingly, the photographer **301** cannot check a captured state of the entire object **302**. Thus, it is necessary for the photographer **301** to operate the smartphone **100** itself or the operation unit **106** to prevent overlapping.
(38) FIG. **3**C is a diagram illustrating operation to move the LV image **304** to be superimposed, in order to avoid overlapping of the object **302** and the LV image **304** having occurred in FIG. **3**B. The photographer **301** operates the touch panel **106***a* of the smartphone **100** with a finger **305**, to move the LV image **304** to another position **306**. In a case where a region of the object **302** is large, however, the object **302** and the LV image **304** can overlap each other even though the photographer **301** moves the LV image **304** to the other position **306**. It is necessary for the photographer **301** to suspend the imaging/distribution, and to avoid overlapping of the object **302** and the LV image **304** by operating the operation unit **106** of the smartphone **100**. For this reason, the photographer **301** cannot concentrate on the imaging/distribution.
(39) FIG. **4** is a flowchart illustrating control processing to automatically suppress overlapping of the object and the PIP window according to the present exemplary embodiment. The flowchart in FIG. **4** is realized when the CPU **101** executes programs stored in the nonvolatile memory **103**. The flowchart in FIG. **4** is started when the function of the smartphone **100** is shifted to a camera function.
(40) In step S**401**, the CPU **101** starts driving of the rear camera **114**, the front camera **115**, the rear camera image processing unit **104**, and the front camera image processing unit **116**, thereby shifting a state to a camera imaging standby state.
(41) In step S**402**, the CPU **101** displays an LV image acquired through a first lens on the display **105**. In the present exemplary embodiment, the LV image acquired through the first lens is an LV image captured by the rear telephoto camera **114***a*. However, the LV image to be displayed can be an LV image acquired by the rear standard camera **114***b*, the rear super wide-angle camera **114***c*, the front standard camera **115***a*, or the front super wide-angle camera **115***b*. The photographer can select the LV image captured by the rear camera **114** or the front camera **115** to be displayed on the display **105** from candidates displayed on the display **105** by operating the operation unit **106**.
(42) In step S**403**, the CPU **101** stores information on the camera used to capture a main image on the display **105** in the memory **102**. The main image is an image currently displayed as the LV image on the entire display **105**, and is an image to be superimposed as a first captured image. In the present exemplary embodiment, information that the rear telephoto camera **114***a* (first lens) is used is stored in the memory **102**.
(43) In step S**404**, the CPU **101** determines whether an instruction to start moving image recording has been input from the operation unit **106**. In a case where the instruction has been input (YES in step S**404**), the processing proceeds to step S**405**. Otherwise (NO in step S**404**), the processing proceeds to step S**410**.
(44) In step S**405**, the CPU **101** performs processing to start moving image recording, and the processing then proceeds to step S**500**.
(45) The processing to start moving image recording includes at least one or more of processing to newly generate a moving image file, processing to record a start time, processing to start recording in the recording medium **108**, or the like.
(46) In step S**500**, the CPU **101** performs object detection/display change processing. The

processing is described below with reference to a flowchart in FIG. **5**.

(47) In step S**406**, the CPU **101** determines whether a moving image is being recorded. In a case where a moving image is being recorded (YES in step S**406**), the processing proceeds to step S**407**. Otherwise (NO in step S**406**), the CPU **101** determines that a moving image is being distributed, and the processing proceeds to step S**412**.

(48) In step S**407**, the CPU **101** writes the LV images acquired by the rear camera **114** and the front camera **115** or a combined image as a moving image frame in the recording medium **108** via the recording medium OF **107**. At this time, the photographer can select either recording the combined image or separately recording the LV images. In other words, in a case where the combined image in which a second captured image is superimposed on the first captured image is displayed on the display **105** as described below, the photographer can select either recording the combined image as one moving image file or recording the first captured image and the second captured image as different moving image files. The CPU **101** records the LV images or the combined image in a recording format corresponding to selection of the photographer. In a case where the first captured image and the second captured image are recorded as different moving image files, the CPU **101** performs the following recording processing. Even in a case where a combined image in which the second captured image is superimposed on a third captured image is displayed on the display **105** as described below, the CPU **101** continuously records the first captured image and the second captured image as different moving image files.

(49) In step S**408**, the CPU **101** determines whether an instruction to end the moving image recording or an instruction to end the moving image distribution has been input. In a case where the instruction has been input (YES in step S**408**), the processing proceeds to step S**409**. Otherwise (NO in step S**408**), the processing proceeds to step S**413**.

(50) In step S**409**, the CPU **101** stops the moving image recording processing or the moving image distribution processing. The CPU **101** stops the moving image distribution processing by stopping transmission of the moving image to the Internet **111** via the communication OF **110**.

(51) In step S**410**, the CPU **101** determines whether an instruction to start moving image distribution has been input from the operation unit **106**. In a case where the instruction has been input (YES in step S**410**), the processing proceeds to step S**411**. Otherwise (NO in step S**410**), the processing returns to step S**402**. In a case where neither the instruction to start the moving image recording or the instruction to start the moving image distribution have been input in steps S**404** and S**410**, the processing returns to step S**402**, and the CPU **101** continues the imaging standby state. Alternatively, the CPU **101** can determine to capture a still image and perform processing to capture a still image.

(52) In step S**411**, the CPU **101** performs processing to start moving image distribution. The processing to start moving image distribution includes at least one or more of connection with the Internet **111** via the communication OF **110**, determination of a moving image file transmission destination server, authentication to the moving image file transmission destination server, or the like. The CPU **101** can write the combined image as the moving image frame in the recording medium **108** via the recording medium OF **107** at the same time when the processing to start moving image distribution is performed. At this time, the CPU **101** records the combined image as one moving image file.

(53) In step S**412**, the CPU **101** transmits the LV images acquired by the rear camera **114** and the front camera **115** or the combined image as the moving image frame to the Internet **111** via the communication OF **110**.

(54) In step S**413**, the CPU **101** determines whether the camera used for main image acquisition is a third lens different from the first lens. In a case where the used lens is the third lens (YES in step S**413**), the processing proceeds to step S**505** in FIG. **5** described below. Otherwise (NO in step S**413**), the processing returns to step S**500**.

(55) In step S**414**, the CPU **101** determines whether operation to end the camera function has been

performed on the operation unit **106**. In a case where the operation to end the camera function has been performed (YES in step S**414**), the CPU **101** stops driving of the rear camera **114**, the front camera **115**, the rear camera image processing unit **104**, and the front camera image processing unit **116**, thereby ending the camera function. Otherwise (NO in step S**414**), the processing returns to step S**402**.
(56) FIG. **5** is a flowchart illustrating the object detection/display change processing in step S**500** described above.
(57) In step S**501**, the CPU **101** acquires the LV image captured through the first lens as the first captured image. In the present exemplary embodiment, the LV image captured through the first lens is the LV image captured by the rear telephoto camera **114***a*.
(58) In step S**502**, the CPU **101** acquires an LV image captured through a second lens as a second captured image. In the present exemplary embodiment, the LV image captured through the second lens is an LV image captured by the standard front camera **115***a*.
(59) The first lens and the second lens can be any combination of the cameras of the rear camera **114** and the front camera **115**.
(60) In step S**503**, the CPU **101** superimposes the second captured image on the first captured image in a size of a region So, and displays a resultant image on the display **105** in a PIP mode. In the present exemplary embodiment, the CPU **101** controls the rear telephoto camera image processing unit **104***a* and the front standard camera image processing unit **116***a* to generate a combined image in which the second captured image is combined with the first captured image.
(61) In step S**504**, the CPU **101** calculates a size, a positional coordinate (xo, yo), a width Wo, and a height Ho of the region So where the second captured image is superimposed, and stores the values in the memory **102**.
(62) Processing in steps S**503** and S**504** can be performed at any timing before start of the moving image recording or before start of the moving image distribution.
(63) In step S**505**, the CPU **101** controls the rear camera image processing unit **104** or the front camera image processing unit **116** to perform object detection processing for detecting an object in the first captured image. In the present exemplary embodiment, the CPU **101** controls the rear telephoto camera image processing unit **104***a* to perform the object detection processing based on the LV image acquired by the rear telephoto camera **114***a*.
(64) In step S**506**, the CPU **101** determines whether the object has been detected based on a result of the object detection processing. In a case where the CPU **101** determines that the object has been detected (YES in step S**506**), the processing proceeds to step S**507**. Otherwise (NO in step S**506**), the processing in step S**500** ends.
(65) In step S**507**, the CPU **101** controls the rear camera image processing unit **104** or the front camera image processing unit **116** to calculate a size, a positional coordinate (x, y), a width W, and a height H of an object detection region S in the first captured image, and stores the values in the memory **102**. In the present exemplary embodiment, the CPU **101** controls the rear telephoto camera image processing unit **104***a* to calculate the object detection region S in the LV image acquired by the rear telephoto camera **114***a*. As described below, in a case where the main image acquisition lens is changed to the third lens (in present exemplary embodiment, rear standard camera **114***b* or rear super wide-angle camera **114***c*), the object detection region S is changed to an object detection region S′ having a positional coordinate (x′, y′), a width W′, and a height H′. In other words, in the present exemplary embodiment, in a case where the processing proceeds from step S**413** in FIG. **4** to steps S**505**, S**506**, and S**507**, the CPU **101** controls the standard camera image processing unit **104***b* or the super wide-angle camera image processing unit **104***c* to calculate the object detection region S′.
(66) In step S**508**, the CPU **101** determines whether the region So where the second captured image is superimposed overlaps with the object detection region S. In a case where the CPU **101** determines that the region So overlaps with the object detection region S (YES in step S**508**), the

processing proceeds to step S**509**. Otherwise (NO in step S**508**), the processing in step S**500** ends.
(67) In the case where the CPU **101** determines that the region So overlaps with the object detection region S, the processing may not immediately proceed to step S**508**, and processing to perform comparison with a threshold as described below may be performed.
(68) First processing is processing to compare an overlapping area with a threshold. More specifically, the CPU **101** determines whether an overlapping area of the region So where the second captured image is superimposed and the object detection region S is greater than or equal to a predetermined first threshold. In a case where the CPU **101** determines that the overlapping area is greater than or equal to the predetermined first threshold, the processing proceeds to step S**509**. Otherwise, the processing in step S**500** ends.
(69) Second processing is processing to compare an overlapping time with a threshold. More specifically, the CPU **101** determines whether a time when the region So where the second captured image is superimposed overlaps with the object detection region S is greater than or equal to a predetermined second threshold. In a case where the CPU **101** determines that the time is greater than or equal to the predetermined second threshold, the processing proceeds to step S**509**. Otherwise, the processing in step S**500** ends.
(70) In step S**509**, the CPU **101** determines whether the camera is switchable to a camera having a lens wider in angle of view. More specifically, the CPU **101** determines whether the camera is switchable to, among a plurality of cameras provided on the surface provided with the camera currently acquiring the first captured image, a camera having a lens wider in angle of view than the lens of the camera acquiring the first captured image. For example, in a case where the first captured image is currently acquired using the rear telephoto camera **114***a*, the CPU **101** determines that the camera is switchable to a camera having a lens wider in angle of view because the camera is switchable to the rear standard camera **114***b* or the rear super wide-angle camera **114***c* as the camera having the lens wider in angle of view. In contrast, in a case where the first captured image is currently acquired using the rear super wide-angle camera **114***c*, the CPU **101** determines that the camera is not switchable to the camera having the lens wider in angle of view because a camera having a lens wider in angle of view than the lens of the rear super wide-angle camera **114***c* is not present. In this example, the case where the first captured image is the image captured by the rear camera **114** is described, but even in a case where the first captured image is the image captured by the front camera **115**, the determination is similarly performable.
(71) In a case where the CPU **101** determines that the camera is switchable to the camera having the lens wider in angle of view (YES in step S**509**), the processing proceeds to step S**510**. Otherwise (NO in step S**509**), the processing proceeds to step S**513**.
(72) In step S**510**, the CPU **101** changes information on the camera used to capture the main image on the display **105** to information on the camera having the lens wider in angle of view that is determined to be switchable, and stores the information in the memory **102**. In the present exemplary embodiment, the information is changed to information on the rear standard camera **114***b* (third lens), and the information is stored in the memory **102**.
(73) In step S**511**, the CPU **101** acquires an LV image captured through the third lens as the third captured image. In the present exemplary embodiment, the LV image captured through the third lens is an LV image captured by the rear standard camera **114***b*.
(74) In step S**512**, the CPU **101** superimposes the second captured image on the third captured image in the size of the region So, and displays a resultant image on the display **105** in the PIP mode. In the present exemplary embodiment, the CPU **101** controls the standard camera image processing unit **104***b* and the front standard camera image processing unit **116***a* to generate a combined image in which the second captured image is combined with the third captured image.
(75) In the present exemplary embodiment, the case where, in the series of processing in steps S**509** to S**512**, the LV image captured through the third lens is the LV image captured by the rear standard camera **114***b* is described. In a case where the CPU **101** determines that the camera is switchable to

the rear super wide-angle camera **114***c*, the LV image can be acquired by switching the camera to the rear super wide-angle camera **114***c*.
(76) In step S**513**, the CPU **101** determines whether an extraction region of the first captured image is changeable, namely, whether the angle of view is changeable to the wide-angle side by the electronic zoom. In a case where the CPU **101** determines that the extraction region is changeable (YES in step S**513**), the processing proceeds to step S**514**. Otherwise (NO in step S**513**), the processing proceeds to step S**516**.
(77) In step S**514**, the CPU **101** changes the extraction region of the first captured image, namely, performs electronic zoom processing. In the present exemplary embodiment, the CPU **101** controls the rear telephoto camera image processing unit **104***a* to perform processing to change the extraction region of the LV image acquired by the rear telephoto camera **114***a*.
(78) In step S**515**, the CPU **101** superimposes the second captured image on the first captured image including the changed extraction region in the size of the region So, and displays a resultant image on the display **105** in the PIP mode.
(79) In step S**516**, the CPU **101** changes the superimposing position of the second captured image on the first captured image. At this time, the CPU **101** changes the position of the second captured image to any one of four corners of the first captured image. The CPU **101** may not perform the processing to change the position of the second captured image, and can delete (hide) the second captured image from the display **105** and display at least one of the first captured image and the third captured image on the display **105**.
(80) FIGS. **6**A and **6**B are diagrams respectively illustrating a moving image capturing/recording screen and an image display setting screen on the smartphone according to the present exemplary embodiment.
(81) FIG. **6**A is a diagram illustrating a screen example when the photographer selects the camera function of the smartphone **100** by using the operation unit **106** and the smartphone **100** is put into the imaging standby state.
(82) When the photographer performs a "touch-down" on any of icons **601** to **608** displayed on the display **105** by using the touch panel **106***a*, a corresponding setting or function can be activated. Performing a "touch-down" on the icon **601** enables switching the rear camera **114** and the front camera **115** used to acquire the LV image to be displayed on the display **105**.
(83) The icons **602** to **604** each represent an imaging function. A still image capturing function is activated in response to a "touch-down" on a "picture" character icon **602**, a moving image capturing function is activated in response to a "touch-down" on a "video" character icon **603**, and a moving image distribution function to the Internet **111** is activated in response to a "touch-down" on a "LIVE" character icon **604**. A magnification icon **605** represents a current magnification. Performing a "touch-down" on the magnification icon **605** enables switching the magnification of the rear camera **114** or the front camera **115** currently used. The camera can be switched to the rear telephoto camera **114***a* when the magnification is increased to a certain threshold or more, whereas the camera can be switched to the rear super wide-angle camera **114***c* when the magnification is reduced to a certain threshold or less. Likewise, the front camera **115** can be switched to the front super wide-angle camera **115***b* when the magnification is reduced to a certain threshold or less. The magnification can be switched to the wide-angle side in response to a "pinch-in" on the touch panel **106***a*, and the magnification can be switched to the telephoto side in response to a "pinch-out", without performing a "touch-down" on the magnification icon **605**.
(84) The icon **606** represents a camera setting function. When the photographer performs a "touch-down" on the icon **606**, the screen is shifted to a screen to set a moving image recording system, a moving image distribution destination, and the like. When the photographer performs a "touch-down" on the icon **607**, a screen display system can be set. Details of the operation are described below with reference to FIG. **6**B. When the photographer performs a "touch-down" on the icon **608**, a still image is captured and stored in a case where the still image capturing function is

activated, recording of a moving image is started/stopped in a case where the moving image capturing function is activated, and moving image distribution can be started/stopped in a case where the moving image distribution function is activated.

(85) The operation can be performed using at least one of the buttons of the operation unit **106** without being limited to the touch panel **106***a*.

(86) FIG. **6**B is a diagram illustrating a screen display mode setting screen shifted in response to a “touch-down” of the icon **607**. Options **609** indicate display modes of the LV images, and the photographer can select a desired display mode in imaging by performing a “touch-down” on the corresponding option **609**. For example, an option **609***a* represents that the rear telephoto camera **114***a* and the front standard camera **115***a* are used for the PIP imaging. When the option **609***a* is selected, the LV images are acquired by the rear telephoto camera **114***a* and the front standard camera **115***a*, and the LV images are displayed in a PIP window mode by superimposing the LV image acquired by the front standard camera **115***a* on the LV image acquired by the rear telephoto camera **114***a*. The options **609** can be set together for images to be displayed on the screen and for the image used for moving image recording/moving image distribution, or can be separately set such that the images are displayed on the screen in the PIP window mode, but only the LV image by the rear telephoto camera **114***a* is used for moving image recording/moving image distribution.

(87) The options **609** are not limited to combinations illustrated in FIG. **6**B. For example, two cameras of the rear camera **114** can be used in combination, or the LV image acquired by the rear camera **114** can be superimposed on the LV image acquired by the front camera **115**.

(88) FIGS. **7**A and **7**B are diagrams each illustrating relationship of the object and a display region of the PIP window. FIG. **7**A is a diagram illustrating an example in which an LV image **701** acquired by the rear telephoto camera **114***a* is displayed on the display **105**.

(89) The coordinate (xo, yo), the width Wo, and the height Ho are calculated to superimpose an LV image acquired by the front standard camera **115***a* on the LV image **701** in a size of the region So (**702** in FIGS. **7**A and **7**B) illustrated by a thick line.

(90) The object detection region S (**703** in FIG. **7**A) illustrated by a dashed line is a region where the object is detected by the rear telephoto camera image processing unit **104***a* and a size of the object is calculated in steps S**505** to S**507**.

(91) In FIG. **7**A, as an example, calculation is performed on the assumption that the positional coordinate (x, y) of the object is at an upper left, but the positional coordinate at any position in the object detection region S (**703** in FIG. **7**A) can be used. The width W and the height H are calculated in order to calculate a size of the object detection region S (**703** in FIG. **7**A) as a rectangle, but the rectangle of the region is not limited thereto, and any method can be used as long as the size of the object can be calculated.

(92) In this example, when the LV image acquired by the front standard camera **115***a* is superimposed on the LV image **701** in the region So (**702** in FIGS. **7**A and **7**B), namely, is displayed in the PIP window mode, a part of the region So and a part of the object detection region S overlap with each other in an overlapping region **704**.

(93) An LV image **705** in FIG. **7**B is acquired in a manner that the CPU **101** determines overlapping in step S**508**, and switches the camera from the rear telephoto camera **114***a* to the rear standard camera **114***b* or the rear super wide-angle camera **114***c*. The LV image **705** can be an image obtained by performing electronic zoom processing on the LV image acquired by the rear telephoto camera **114***a*. The angle of view is changed by switching of the rear camera **114** or the electronic zoom processing. Accordingly, the object detection region S (**706** in FIG. **7**B) is smaller than the object detection region S (**703** in FIG. **7**A) in FIG. **7**A.

(94) The positional coordinate (x′, y′), the width W′, and the height H′ of the object are calculated again to acquire the LV image **705**. The CPU **101** performs the processing in steps S**508** to S**516** until the overlapping region **704** in FIG. **7**A is eliminated by switching of the rear camera **114** or the electronic zoom processing. In a case where after the processing is performed to eliminate the

overlapping region **704** once but the overlapping region **704** appears again, the processing in steps S**508** to S**516** can be repeated.
(95) As described above, according to the present exemplary embodiment, in the case where the object and the captured image (PIP window) to be superimposed overlap with each other as in FIG. **7**A, the CPU **101** changes the angle of view by switching the camera to the rear camera **114** on the wide-angle side or the front camera on the wide-angle side. Displaying the object and the PIP window so as not to overlap with each other enables capturing the entire object. Accordingly, it is possible to improve visibility of the object. It is unnecessary for the photographer to suspend the desired imaging or the desired distribution and to operate the angle of view on the operation unit **106**. In this way, the photographer can concentrate on the desired imaging or the desired distribution.
(96) In the above-described present exemplary embodiment, a smartphone was used as an example of the electronic apparatus. This is not seen to be limiting, and the present exemplary embodiment is applicable to any electronic apparatus including a plurality of lenses different in angle of view. In other words, the present exemplary embodiment is applicable to, for example, a personal computer, a personal digital assistant (PDA), a digital camera, a portable image viewer, a digital photo frame, a music player, a game machine, an electronic book reader, and the like.
(97) While the present disclosure is described in detail based on an exemplary embodiment, this exemplary embodiment is not seen to be limiting, and various modes that enable practice of the above-described features are applicable.
OTHER EMBODIMENTS
(98) Embodiment(s) 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.
(99) While the above-described exemplary embodiments have been described, they are not seen to be limiting. 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.
(100) This application claims the benefit of Japanese Patent Application No. 2022-029380, filed Feb. 28, 2022, which is hereby incorporated by reference herein in its entirety.

Claims

1. An electronic apparatus comprising: a plurality of lenses, each having different angles of view; a processor; and a memory storing a program which, when executed by the processor, causes the electronic apparatus to: acquire a first captured image captured using a first lens from among the

plurality of lenses; acquire a second captured image captured using a second lens from among the plurality of lenses, wherein the second lens is different from the first lens; acquire a third captured image captured using a third lens from among the plurality of lenses, wherein the third lens is wider in angle of view than the first lens; superimpose the second captured image on the first captured image; detect an object from the first captured image; generate a combined image where the second captured image is superimposed on the first captured image in a case where a region of the detected object does not overlap with a region where the second captured image is superimposed; and generate a combined image where the second captured image is superimposed on the third captured image in a case where the region of the detected object overlaps with the region where the second captured image is superimposed, wherein, the combined image is caused to be displayed where the second captured image is superimposed on the first captured image or the combined image where the second captured image is superimposed on the third captured image, and the first captured image is caused to be displayed without superimposing the second captured image in a case where the third captured image is not acquirable.

2. The electronic apparatus according to claim 1, wherein the first lens and the third lens are provided on a first surface of the electronic apparatus, and wherein the second lens is provided on a second surface different from the first surface.

3. The electronic apparatus according to claim 1, wherein, when the program is executed by the processor, the program further causes the electronic apparatus to record the first captured image in a recording medium regardless of whether the combined image where the second captured image is superimposed on the first captured image is generated or the combined image where the second captured image is superimposed on the third captured image is generated.

4. The electronic apparatus according to claim 1, wherein, when the program is executed by the processor, the program further causes the electronic apparatus to output the combined image where the second captured image is superimposed on the first captured image or the combined image where the second captured image is superimposed on the third captured image from the electronic apparatus.

5. The electronic apparatus according to claim 1, wherein, when the program is executed by the processor, the program further causes the electronic apparatus to record the combined image where the second captured image is superimposed on the first captured image or the combined image where the second captured image is superimposed on the third captured image in a recording medium.

6. The electronic apparatus according to claim 1, wherein the combined image where the second captured image is superimposed on the third captured image is generated in a case where an overlapping area of the region of the detected object and the region where the second captured image is superimposed is greater than or equal to a predetermined first threshold.

7. The electronic apparatus according to claim 1, wherein the combined image where the second captured image is superimposed on the third captured image is generated in a case where a time when the region of the detected object overlaps with the region where the second captured image is superimposed is greater than or equal to a predetermined second threshold.

8. The electronic apparatus according to claim 1, wherein, when the program is executed by the processor, the program further causes the electronic apparatus to generate a combined image by moving the region where the second captured image is superimposed in a case where the third captured image is not acquirable.

9. A method of controlling an electronic apparatus including a plurality of lenses each having different angles of view, the method comprising: acquiring a first captured image captured using a first lens from among the plurality of lenses; acquiring a second captured image captured using a second lens from among the plurality of lenses, wherein the second lens is different from the first lens; acquiring a third captured image captured using a third lens from among the plurality of lenses, wherein the third lens is wider in angle of view than the first lens; superimposing the second

captured image on the first captured image; detecting an object from the first captured image; generating a combined image where the second captured image is superimposed on the first captured image in a case where a region of the detected object does not overlap with a region where the second captured image is superimposed; and generating a combined image where the second captured image is superimposed on the third captured image in a case where the region of the detected object overlaps with the region where the second captured image is superimposed; and displaying the combined image where the second captured image is superimposed on the first captured image or the combined image where the second captured image is superimposed on the third captured image, and displaying the first captured image without superimposing the second captured image in a case where the third captured image is not acquirable.

10. A non-transitory computer-readable medium that stores a program, which when executed causes an electronic apparatus including a plurality of lenses each having different angles of view to execute a method, the method comprising: acquiring a first captured image captured using a first lens from among the plurality of lenses; acquiring a second captured image captured using a second lens from among the plurality of lenses, wherein the second lens is different from the first lens; acquiring a third captured image captured using a third lens from among the plurality of lenses, wherein the third lens is wider in angle of view than the first lens; superimposing the second captured image on the first captured image; detecting an object from the first captured image; generating a combined image where the second captured image is superimposed on the first captured image in a case where a region of the detected object does not overlap with a region where the second captured image is superimposed; and generating a combined image where the second captured image is superimposed on the third captured image in a case where the region of the detected object overlaps with the region where the second captured image is superimposed; and displaying the combined image where the second captured image is superimposed on the first captured image or the combined image where the second captured image is superimposed on the third captured image, and displaying the first captured image without superimposing the second captured image in a case where the third captured image is not acquirable.