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(54) **IMAGE PICKUP APPARATUS AND CONTROL METHOD OF IMAGE PICKUP APPARATUS**

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(57) **ABSTRACT**

When an image is photographed vertically, vertical position information is added to the image. When an upside-down image is photographed, data itself is rotated by 180 degrees and recorded. Thus, when the image is reproduced by a general another reproducing apparatus, the image can be viewed with the too and bottom thereof being normally positioned.

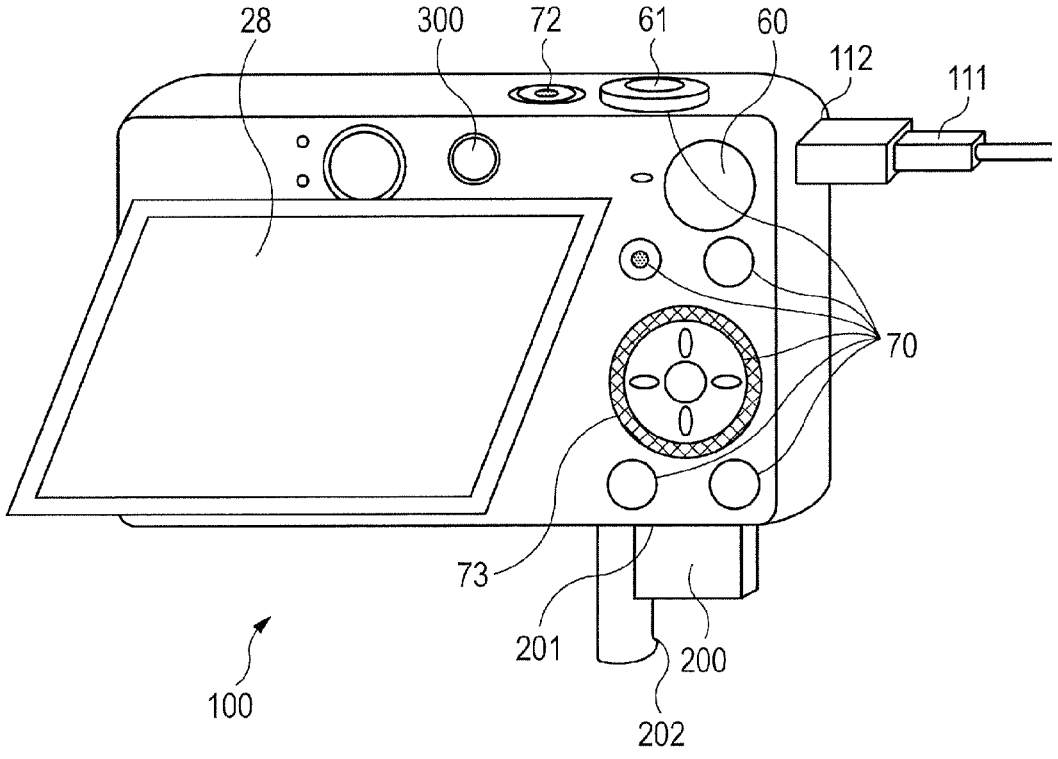

FIG. 1

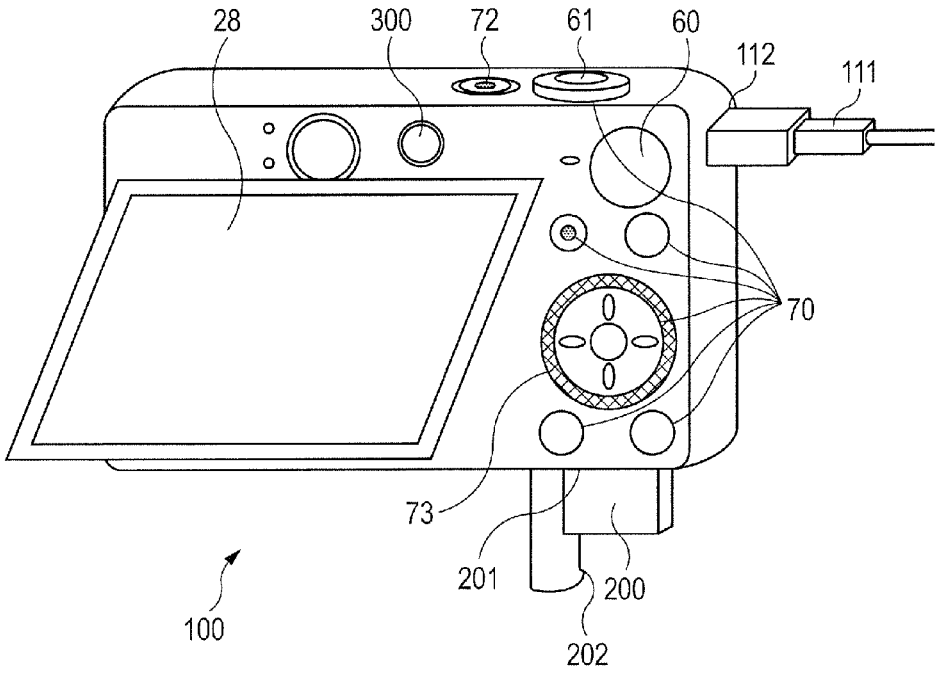

FIG. 2

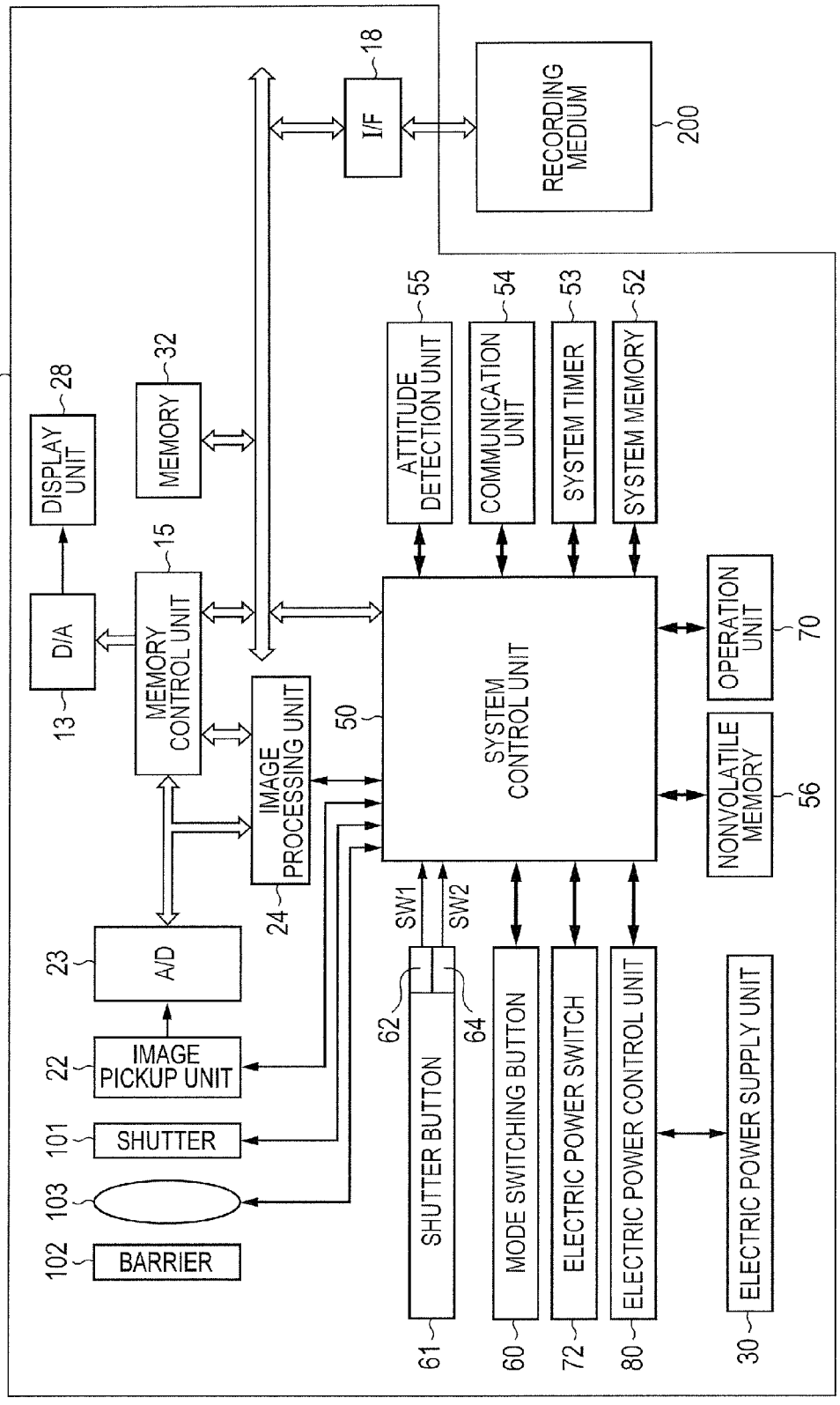
100
18
I/F
RECORDING MEDIUM
200
55
ATTITUDE DETECTION UNIT
54
COMMUNICATION UNIT
53
SYSTEM TIMER
52
SYSTEM MEMORY
28
DISPLAY UNIT
32
MEMORY
15
MEMORY CONTROL UNIT
D/A
13
IMAGE PROCESSING UNIT
24
50
SYSTEM CONTROL UNIT
OPERATION UNIT
70
NONVOLATILE MEMORY
56
SW1
SW2
23
A/D
22
IMAGE PICKUP UNIT
101
SHUTTER
103
102
BARRIER
62
64
SHUTTER BUTTON
MODE SWITCHING BUTTON
ELECTRIC POWER SWITCH
ELECTRIC POWER CONTROL UNIT
ELECTRIC POWER SUPPLY UNIT
61
60
72
80
30

FIG. 3

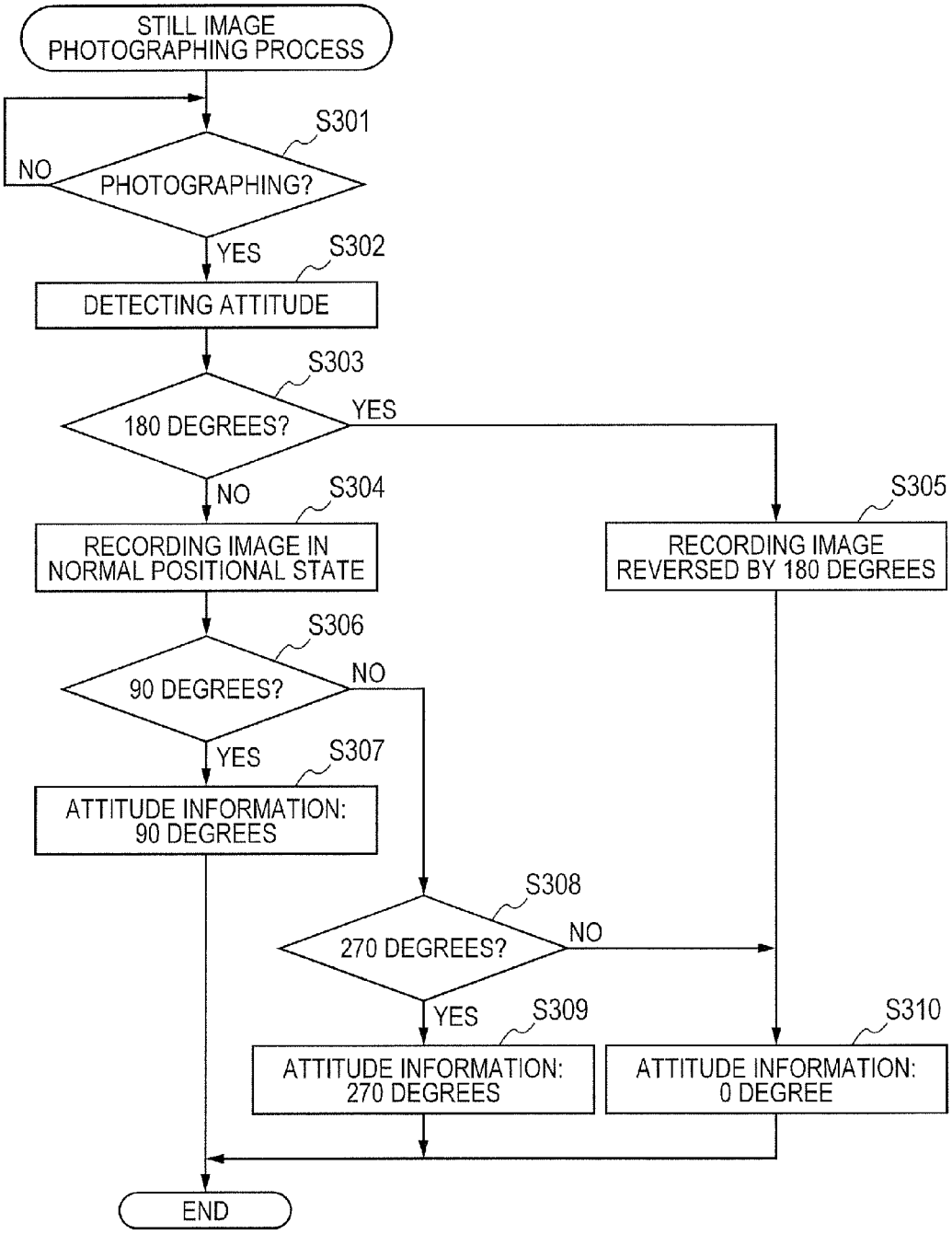
STILL IMAGE PHOTOGRAPHING PROCESS
S301
PHOTOGRAPHING?
NO
YES
S302
DETECTING ATTITUDE
S303
180 DEGREES?
YES
NO
S304
RECORDING IMAGE IN NORMAL POSITIONAL STATE
S305
RECORDING IMAGE REVERSED BY 180 DEGREES
S306
90 DEGREES?
NO
YES
S307
ATTITUDE INFORMATION: 90 DEGREES
S308
270 DEGREES?
NO
YES
S309
ATTITUDE INFORMATION: 270 DEGREES
S310
ATTITUDE INFORMATION: 0 DEGREE
END

FIG. 4

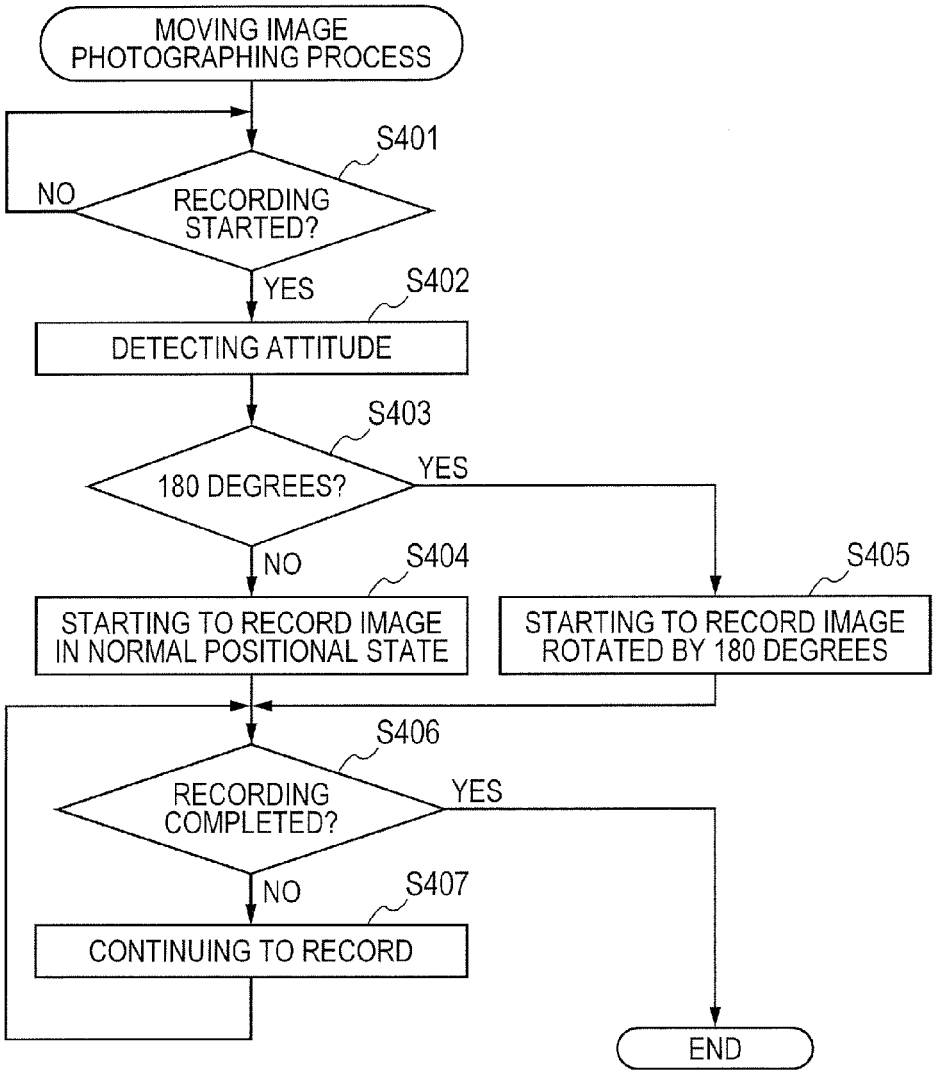
MOVING IMAGE PHOTOGRAPHING PROCESS
S401
RECORDING STARTED?
NO
YES
S402
DETECTING ATTITUDE
S403
180 DEGREES?
YES
NO
S404
STARTING TO RECORD IMAGE IN NORMAL POSITIONAL STATE
S405
STARTING TO RECORD IMAGE ROTATED BY 180 DEGREES
S406
RECORDING COMPLETED?
YES
NO
S407
CONTINUING TO RECORD
END

IMAGE PICKUP APPARATUS AND CONTROL METHOD OF IMAGE PICKUP APPARATUS

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to an image pickup apparatus and a control method of the image pickup apparatus and, more particularly, to a recording and reproducing technique of a photographed image, suitable for use in an image pickup apparatus arranged to detect an attitude.

[0003] 2. Description of the Related Art

[0004] When an image pickup apparatus is used to photograph an image, there may be a case where the image pickup apparatus is held vertically as well as a case where being held in a conventionally normal positional state. In this instance, there has been known a method whereby angle information showing a photographing angle is added to image information showing a photographed image, the image is rotated and displayed on an image reproducing apparatus side on the basis of the angle information, and a browsing person views the image with the top and bottom thereof being normally positioned.

[0005] Japanese Patent Application Laid-Open No. S58-182977 proposes an image information reproducing apparatus constructed in such that in the case where an image is photographed vertically, an attitude flag showing that the image is photographed vertically is added, and at the time of reproduction, the image is rotated vertically and displayed.

[0006] Japanese Patent Application Laid-Open No. 2004-208096 proposes such a digital camera that when an image is photographed vertically, a frame for a framing assistance is displayed, and in the case where the image is photographed in such a state, the photographed image is recorded in a state where it is rotated by 90 or 270 degrees.

[0007] Such image pickup apparatuses that a display apparatus portion is closable or rotatable to a main body of the image pickup apparatus has also been known. Those image pickup apparatuses can in an arbitrary angular state to photograph. There is also a product which presumes a usage case where the image pickup apparatus is held upside down.

[0008] If a vertical image photographed by holding the image pickup apparatus vertically is displayed by adjusting the top and bottom of the image to those of a display apparatus and further fitting the image into a general landscape display area, the image is reduced more than that in the case where the image is displayed so as to fit into a vertically long display area. Therefore, in a display apparatus which can be held in a hand of the user of a portable phone terminal, a digital camera, or the like, in order to largely display a vertical image with a full screen, there is a case where the function for performing the rotational display according to the attitude flag as disclosed in Japanese Patent Application Laid-Open No. S58-182977 is used purposely in an off state. In such a case, the vertical image having a flag of 90 degrees is displayed so that the top and bottom thereof are positioned in the lateral direction of the display apparatus.

[0009] However, changing a holding state of the display apparatus so as to rotate the display apparatus itself by 90 degrees, the used can change the top and bottom of the image so as to be positioned in the normal direction when seen from the user and can see the largely displayed image. It is assumed here that the rotation of the image according to the attitude of the display apparatus is not performed. The reason why the function for performing the rotational display according to the attitude flag is purposely turned off is that there is such an advantage that the user can see the largely displayed image as mentioned above.

[0010] However, in the case where an image held upside down by 180 degrees is displayed, the user needs to rotate the display apparatus itself by 180 degrees in order to see the image with the top and bottom thereof being positioned in the normal direction. However, even if the display apparatus itself is rotated by 180 degrees, since a size of the image after the rotation of the display apparatus is equal to that of the image before the display apparatus is rotated, the advantage which is caused by turning off the rotational display according to the flag is not obtained for the user. That is, since the user has to rotate the display apparatus, it simply results in a surplus troublesomeness.

[0011] According to the method whereby before the image is recorded, the image itself is rotated in the direction according to the attitude of the image pickup apparatus and the recording is performed as disclosed in Patent Literature 2 of Japanese Patent Application Laid-Open No. 2004-208096, there is such a problem that the vertical image is displayed rather small in the landscape display area.

[0012] The foregoing problem also occurs similarly in a display apparatus which does not inherently have the function for performing the rotational di-play according to the attitude flag.

SUMMARY OF THE INVENTION

[0013] The invention is made in consideration of the foregoing problems and it is an aspect of the invention to enable an image photographed by vertically holding an image pickup apparatus to be largely displayed onto a display apparatus. It is another aspect of the invention to provide an image pickup apparatus which performs such a recording that an image photographed by holding the image pickup apparatus upside own can be displayed by a display apparatus so that the top and bottom of the image are displayed in the normal direction.

[0014] According to an aspect of the invention, an image pickup apparatus comprises: an image pickup unit; an attitude detection unit configured to detect an attitude of the image pickup unit; and a control unit configured to control on the basis of the attitude detected by the attitude detection unit when the photographing by the image pickup unit is performed, in such a manner that in a case where the image pickup unit is held vertically and the image is photographed, the photographed image is recorded into a recording medium without being rotated, and attitude information showing that the image pickup unit is held vertically is recorded as attribution information into the recording medium in association with the image, and in a case whereat image is photographed by holding the image pickup unit upside down, the photographed image is rotated upside down and recorded into the recording medium, and attitude information showing that the image pickup unit is held upside down is not added.

[0015] Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate

exemplary embodiments, features, and aspects of the invention and, together with the description, serve to explain the principles of the invention.

[0017] FIG. **1** is a diagram illustrating an example of a rear view of an external appearance of an image pickup apparatus of an embodiment.

[0018] FIG. **2** is a block diagram illustrating an example of a hardware construction of the image pickup apparatus of the embodiment.

[0019] FIG. **3** is a flowchart for describing the image generating operation to a direction of the image pickup apparatus in a still image photographing according to the embodiment of the invention.

[0020] FIG. **4** is a flowchart for describing the moving image generating operation to a direction of the image pickup apparatus in a moving image photographing according to the embodiment of the invention.

DESCRIPTION OF THE EMBODIMENTS

[0021] Various exemplary embodiments, features, and aspects of the present invention will be described in detail below with reference to the drawings.

[0022] In the present embodiment, FIG. **1** illustrates an external view of a digital camera as an example of an image pickup apparatus having an image pickup unit for photographing an object image and obtaining a photographed image.

[0023] In a digital camera **100** of the embodiment, a display unit **28** displays an image and various kinds of information. A backlight is mounted to the display unit **28** so that displayed contents are visible even in a dark place.

[0024] The display unit **28** is mounted through a close and open mechanism to an apparatus main body of the digital camera **100**. The display unit **28** has the following variable angle mechanism for enabling an angle of the display unit **28** to be adjusted. That is, when a low-angle shot is performed by the image pickup apparatus being held at a lower position, while the image pickup apparatus itself is directed upward, the display unit **28** can be adjusted to the angle at which the photographer can easily see. On the contrary, when a high-angle shot is performed by the image pickup apparatus being held at a higher position, and by holding the image pickup apparatus upside down, the display unit **28** can be adjusted to the angle at which the photographer can easily see while the image pickup apparatus itself is directed downward.

[0025] A shutter button **61** is an operation unit to instruct the photographing and can be depressed at two stages including a half-depression state. A mode switching button **60** is an operation unit to change over various kinds connecting cable and the digital camera **100**.

[0026] An operation unit **70** is constructed by operation members such as various kinds of switches for receiving various kinds of operations from the user, button, touch panel, and the like. A controller wheel **73** is a rotatable operation member included in the operation unit **70**. An electric power switch **72** is provided to change over a power-on and a power-off.

[0027] An In-camera **300** is used to photograph an appreciating person or photographer. A recording medium **200** is a memory card, a hard disk, or the like. A recording medium slot **201** is provided to insert the recording medium **200**. The recording medium **200** inserted in the recording medium slot **201** can communicate with the digital camera **100**. A cover **202** is provided to cover the recording medium slot **201**.

[0028] FIG. **2** is a block diagram illustrating an example of a construction of the digital camera **100** according to the embodiment.

[0029] In FIG. **2**, a photographing lens **103** is a lens group including a zoom lens and a focus lens. A shutter **101** has an iris function. An image pickup unit **22** is an image pickup element constructed by a COD, a CMOS element, or the like for converting an optical image into an electric signal.

[0030] An A/D converter **23** converts an analog signal into a digital signal. The A/D converter **23** is used to convert an analog signal which is output from the image pickup unit **22** into a digital signal. A barrier **102** covers an image pickup system including the photographing lens **103** of the digital camera **100**, thereby preventing a dirt or damage of the image pickup system including the photographing lens **103**, shutter **101**, and image pickup unit **22**.

[0031] An image processing unit **24** executes a resizing process such as predetermined pixel interpolation or reduction and a color converting process to data from a memory control unit **15**. In the image processing unit **24**, a predetermined arithmetic operating process is executed by using the data of the photographed image. A system control unit **50** performs exposure control and distance measurement control on the basis of an obtained arithmetic operation result. Thus, an AF (Auto-Focus) process of a TTL (Through-The-Lens) method, an AB (Auto-Exposure) process, and an BE (flash light pre-emitting) process are executed. In the image processing unit **24**, further, a predetermined arithmetic operating process is executed by using the data of the photographed image and an AWB (Auto-White Balance) process of the TTL method is also executed on the basis of the obtained arithmetic operation result.

[0032] The output data from the A/D converter **23** is written into a memory **32** through the image processing unit **24** and the memory control unit **15** or is directly written into the memory **32** through the memory control unit **15**. The memory **32** also stores the image data which is obtained by the image pickup unit **22** and is converted into the digital data by the A/D converter **23** or the image data to be displayed to the display unit **28**. The memory **32** has a storage capacity enough to store a predetermined number of still images and moving images and audio sound of a predetermined time.

[0033] The memory **32** also functions as a memory (video memory) for displaying the image. A D/A converter **13** converts the image displaying data stored in the memory **32** into an analog signal and supplies to the display unit **28**. The image displaying data written in the memory **32** as mentioned above is displayed by the display unit **28** through the D/A converter **13**.

[0034] The display unit **28** performs a display according to the analog signal from the D/A converter **13** onto a display device such as an LCD or the like. The digital signal which is once A/D converted by the A/D converter **23** and is stored in the memory **32** is converted into the analog signal by the D/A converter **13** and is successively transferred to the display unit **28** and the image is displayed, so that the display unit **28** functions as an electronic viewfinder and is constructed so that a through image can be displayed.

[0035] A nonvolatile memory **56** is an electrically erasable and recordable memory and, for example, an EEPROM or the like is used. Constants, a program, and the like for making the system control unit **50** operative are stored in the nonvolatile memory **56**. The program mentioned here denotes a program

for executing various kinds of flowcharts, which will be described hereinafter in the embodiment.

[0036] The system control unit **50** controls the whole digital camera **100**. By executing the program recorded in the nonvolatile memory **56** mentioned above, each process of the embodiment, which will be described hereinafter, is realized. A RAM is used as a system memory **52**. Constants and variables for making the system control unit **50** operative, the program read out of the nonvolatile memory **56**, and the like are developed in the system memory **52**. The system control unit **50** also makes display control by controlling the memory **32**, D/A converter **13**, display unit **28**, and the like.

[0037] A system timer **53** is a time measuring unit for measuring a time which is used for various kinds of control and a time of a built-in timer.

[0038] The mode switching button **60**, a first shutter switch **62**, a second shutter switch **64**, and the operation unit **70** are operation units for inputting various kinds of operation instructions to the system control unit **50**.

[0039] The mode switching button **60** switches the operation mode of the system control unit **50** to any one of a still image recording mode, a moving image recording mode, a reproducing mode, and the like. As modes included in the still image recording mode, there are an auto-photographing mode, an auto-scene discriminating mode, a manual mode, various kinds of scene modes for providing photographing settings for every photographing scene, a program AE mode, a custom mode, and the like.

[0040] The operation mode is directly switched to any one of those modes included in the still image recording mode by the mode switching button **60**. Or, after the operation mode is temporarily switched to the still image recording mode by the mode switching button **60**, the operation mode may be switched to any one of those modes included in the still image recording mode by using another operation member. Similarly, a plurality of modes may be also included in the moving image recording mode.

[0041] The first shutter switch **62** is turned on during the operation of the shutter button **61** provided for the digital camera **100**, that is, in what is called a half depression state (photographing preparation instruction) and generates a first shutter switch signal SW1. The operations such as AF (Auto-Focus) process, AE (Auto Exposure) process, AWB (Auto-White Balance) process, EF (flash light pre-emitting) process, and the like are started by the first shutter switch signal SW1.

[0042] The second shutter switch **64** is turned on by the completion of the operation of the shutter button **61**, that is, in what is called a full depression (photographing instruction) and generates a second shutter switch signal SW2. By the second shutter switch signal SW2, the system control unit **50** starts the operations of a series of photographing processes from the read-out of the signal from the image pickup unit **22** to the writing of the image data into the recording medium **200**.

[0043] By selectively operating various kinds of function icons displayed onto the display unit **28** or the like, the function is properly allocated for every scene to each operation member of the operation unit **70**, so that the operation members function as various kinds of function buttons. As function buttons, for example, there are an "end" button, a "back" button, an "image feed" button, a "jump" button, a "limit" button, an "attribution change" button, and the like. For example, when a "menu" button is depressed, various kinds of settable menu screens are displayed onto the display unit **28**. The user can intuitively make various kinds of settings by using the menu screens displayed on the display unit **28**, upper, lower, right, and left 4-direction buttons, and a SET button.

[0044] The controller wheel **73** is a rotatable operation member included in the operation unit **70** and is used when a selection item is instructed or the like together with the direction buttons. By rotating the controller wheel **73**, an electric pulse signal is generated in accordance with an operation amount. On the basis of such a pulse signal, the system control unit **50** controls each unit of the digital camera **100**. An angle of the rotation, the number of times of the rotation, and the like of the controller wheel **73** can be discriminated by the pulse signal.

[0045] Any operation member which can detect the rotating operation can be used as a controller wheel **73**. For example, such a dial operation member that the controller wheel **73** itself rotates in accordance with the rotating operation of the user and generates a pulse signal may be used. Such an operation member constructed by a touch sensor that detects the rotating operation of a finger of the user on the controller wheel **73** or the like the controller wheel **73** itself does not rotate may be used (what is called a touch wheel).

[0046] An electric power control unit **80** is constructed by a battery detection circuit, a DC-DC converter, a switch circuit for switching a block to be turned on, and the like and detects the presence or absence of a loading of a battery, a type of battery, and a battery residual capacity. On the basis of a result of the detection and an instruction of the system control unit **50**, the electric power control unit **80** controls the DC-DC converter and supplies a necessary voltage to each unit including the recording medium **200** for a necessary period of time.

[0047] An electric power supply unit **30** is constructed by a primary battery such as alkaline battery, lithium battery, or the like, a secondary battery such as NiCd battery, NiMH battery, Li battery, or the like, an AC adaptor, and the like. A recording medium I/F **18** is an interface with the recording medium **200** such as memory card, hard disk, or the like. The recording medium **200** is recording medium such as a memory card or the like for recording the photographed image and is constructed by a semiconductor memory, a magnetic disk, or the like.

[0048] A communication unit **54** is connected in a wireless manner or by a wired cable and transmits and receives an image signal and an audio signal. The communication unit **54** can be also connected to a wireless LAN (Local Area Network) or Internet. The communication unit **54** can transmit the image (including a through image) picked up by the image pickup unit **22** or the image recorded in the recording medium **200** and can receive image data and other various kinds of information from external apparatuses.

[0049] An attitude detection unit **55** detects an attitude of the digital camera **100** with reference to the direction of gravity. On the basis of the attitude detected by the attitude detection unit **55**, whether or not the image photographed by the image pickup unit **22** is an image photographed by laterally holding the digital camera **100** or an image photographed by vertically holding the digital camera **100** can be discriminated. The system control unit **50** can add information of orientation corresponding to the attitude detected by the attitude detection unit **55** to an image file of the image photographed by the image pickup unit **22** or rotate the image and

record. An acceleration sensor, a gyro sensor, or the like can be used as an attitude detection unit **55**.

[0050] The digital camera **100** can display a still image and a moving image recorded in the recording medium **200** onto the display unit **28**. Whether or not a function for reflecting the attitude information to the image file and displaying the image is turned on or off can be set. When the function is ON, the attitude information added to the image file is read out and the image is rotated to the side opposite to the attitude information by an angle of the attitude information and displayed. For example, if the attitude flag of 90 degrees is added, the image is rotated by minus 90 degrees (by 270 degrees) and displayed. When the function is OFF, the attitude information added to the image file is not read out (or even if the attitude information is read out, it is not used) and the image recorded to the image file is displayed without being rotated.

[0051] Subsequently, a flow for a process in the still image photographing mode will be described as an example of the exemplary embodiments of the image pickup apparatus in the present embodiment with reference to a flowchart of FIG. **3**. The process is realized by a method whereby the program recorded in the nonvolatile memory **56** is developed into the system memory **52** and the system control unit **50** executes the program.

[0052] In S**301**, the digital camera **100** discriminates whether or not the still image photographing operation is provided (that is whether or not the signal SW2 is ON). If it is determined that the still image photographing operation is not the processing routine is returned to S**301** and a similar process is repeated. If it is determined that the still image photographing operation is provided, the processing routine advances to S**302**.

[0053] In S**302**, an image pickup sensor of the digital camera **100** detects the orientation of the camera with reference to the vertical direction and the system control unit **50** holds the detected orientation as attitude information. In S**302**, first, the current attitude information is obtained from the attitude detection unit **55**. An attitude discriminating process discriminating whether or not the obtained attitude is closest to which one of the following four attitudes is executed. A discrimination result is held in the system memory **52** as attitude information showing any of 0 degree, 90 degrees, 180 degrees, and 270 degrees.

(1) State where the camera is held in a normal positional state (0 degree).

(2) State where the camera is held at a vertical position at which it is rotated by 90 degrees (90 degrees).

(3) State where the camera is held upside down (180 degrees).

(4) State where the camera is held at a vertical position at which it is rotated by 270 degrees (that is, upside down vertical position of (2)) (270 degrees).

[0054] Although the timing for obtaining the attitude information from the attitude detection unit **55** is set to the timing just after the photographing, information just before the photographing may be obtained. For example, it is also possible to construct in such a manner that at the time of ON of SW1 (half-depression state of the shatter button **61**) just before SW2 is turned on (full depression state of the shutter button **61**) at the time when the photographing is performed, the attitude information detected by the attitude detection unit **55** is held in the system memory **52** and the attitude is discriminated on the basis of the held attitude information.

[0055] In a self-timer photographing, when there is an instruction to start a self-timer, the attitude information detected by the attitude detection unit **55** is held in the system memory **52**. When there is a start instruction of the self-timer, the attitude may be discriminated on the basis of the held attitude information irrespective of the attitude during the count-down of the self-timer.

[0056] In S**303**, the system control unit **50** discriminates whether or not the attitude information indicates 180 degrees. If the attitude information indicates 180 degrees, S**305** follows. If NO, S**304** follows. In S**305**, the system control unit **50** rotates the image which is photographed and held in the memory **32** by 180 degrees, generates an image file on the basis of the image rotated by 180 degrees and records into the recording medium **200**. In S**310**, the attitude information is set to 0 degree and added to the foregoing image file. The processing routine is finished.

[0057] In S**304**, the system control unit **50** records the photographed image as an image file into the recording medium **200** in a normal positional state (that is, without being rotated).

[0058] In S**306**, the system control unit **50** discriminates whether or not the attitude information held in the system memory **52** indicates 90 degrees. If the attitude information indicates 90 degrees, S**307** follows. If NO, S**308** follows.

[0059] In S**307**, the system control unit **50** adds 90 degrees as attitude information to the image file in which the image is recorded in S**304** and finishes the processing routine.

[0060] In S**308**, the system control unit **50** discriminates whether or not the attitude information held in the system memory **52** indicates 270 degrees. If it is determined that the attitude information indicates 270 degrees, S**309** follows. If NO, that is, if the attitude information indicates 0 degree, S**310** follows.

[0061] In S**309**, the system control unit **50** adds 270 degrees as attitude information to the image file in which the image is recorded in S**304** and finishes the processing routine.

[0062] In S**310**, the system control unit **50** adds 0 degree as attitude information to the image file in which the image is recorded in S**304** and finishes the processing routine.

[0063] In this manner, in the still image photographing process in the present embodiment, the image photographed by holding the camera at each attitude is processed as follows.

[0064] (1) In case of the image photographed in a state where the camera is held at a normal position (0 degree), the image is recorded without being rotated, and the attitude flag showing 0 degree is recorded as attribution information in association with the image.

[0065] (2) in case of the image photographed in a state where the camera is rotated by 90 degrees and held vertically (90 degrees), the image is recorded without being rotated, and the attitude flag showing 90 degrees is recorded as attribution information in association with the image.

[0066] (3) In case of the image photographed in a state where the camera is held upside down (180 degrees), the image is rotated by 180 degrees and recorded, and the attitude flag showing 0 degree is recorded as attribution information in association with the image.

[0067] (4) In case of the image photographed in a state where the camera is rotated by 270 degrees and held vertically (that is, upside-down vertical position of (2)), the image is recorded without being rotated, and the attitude flag showing 270 degrees is recorded as attribution information in association with the image.

[0068] With respect to the image photographed in a state where the camera is rotated by 270 degrees and held verti-

cally, the image may be rotated by 180 degrees and the attitude flag may be set to 90 degrees and recorded. By constructing as mentioned above, in the display to which the attitude flag is reflected, the image can be displayed in a state in which the top and bottom of the displayed image are in a normal positional state without rotating the display apparatus. In spite of it, even in the display to which the attitude flag is not reflected, it is sufficient that a range where the display apparatus is rotated so that the user can correctly view the top and bottom of the displayed image is set to up to 90 degrees.

[0069] That is, even in the case of sequentially displaying the images among the images in which the images of (2) and (4) mentioned above exist mixedly, a motion amount required to change the holding state of the display apparatus by the user can be reduced.

[0070] Only the image photographed by holding the camera upside down as mentioned in (3) may be rotated by 180 degrees and recorded without adding the attitude flag.

[0071] Subsequently, a flow for a process in the moving image photographing mode will be described as an example of the exemplary embodiments of the image pickup apparatus in the embodiment with reference to a flowchart of FIG. **4**. The process is realized by a method whereby the program stored in the nonvolatile memory **56** is developed into the system memory **52** and the system control unit **50** executes the program.

[0072] In S**401**, the system control unit **50** discriminates whether or not the moving image recording start operation is provided. If it is determined that the moving image recording start operation is not provided, the processing routine is returned to S**401** and a similar process is repeated. If it is determined that the moving image recording start operation is provided, the processing routine advances to S**402**.

[0073] In S**402**, the image pickup sensor of the digital camera **100** detects the orientation of the camera with reference to the vertical direction at the time of the recording start and the system control unit **50** holds the detected orientation as attitude information. In S**402**, first, the current attitude information is obtained from the attitude detection unit **55**. Whether or not the attitude is closest to which one of the following two attitudes is discriminated. A discrimination result is held in the system memory **52** as attitude information showing either 0 degree or 180 degrees.

(1) State where the camera is held in a normal positional state (0 degree).

(2) State where the camera is held, upside down (180 degrees).

[0074] In S**403**, the system control unit **50** discriminates whether or not the attitude information indicates 180 degrees. If the attitude information indicates 180 degrees, S**405** follows. If the attitude information indicates 0 degree, S**404** follows.

[0075] In S**405**, the system control unit **50** starts the moving image recording in a state where the data read out by the image pickup sensor is rotated by 180 degrees. Until the recording of the moving image is finished, all of the images are rotated by 180 degrees and recorded.

[0076] In S**404**, the system control unit **50** starts the moving image recording in a state where the data read out by the image pickup sensor is in a conventionally normal positional state (that is, without being rotated). Until the recording of the moving image is finished, all of the images are recorded without being rotated. After S**404** or S**405**, the processing routine advances to S**406**.

[0077] In S**406**, the system control unit **50** discriminates whether or not the operation to finish the moving image recording is instructed. Until the moving image recording finishing operation is instructed, the moving image recording is continued in S**407**, and the discrimination in S**406** is repeated. If it is determined in S**406** that the moving image recording finishing operation is instructed, the moving image recording is stopped.

[0078] According to the embodiment of the invention described above, the still image and moving image photographed by holding the camera upside down can be recorded so as to be displayed in such a manner that the to and bottom of the displayed image are certainly held in the normal orientation with respect to the normal position of the display apparatus irrespective of the function which the display apparatus has.

[0079] Although the case where the invention is applied to the image pickup apparatus is described as an example in the foregoing embodiment, the invention is not limited to such an example but can be also applied to any apparatus having the image pickup unit. That is, the invention can be applied to a portable phone terminal, a portable image viewer, or the like.

Other Embodiments

[0080] The invention is also realized by executing the following processes. That is, software (program) for realizing the functions of the embodiment mentioned above is supplied to a system or apparatus through a network or various kinds of storage media, a computer (or a CPU, MPU, or the like) of the system or apparatus reads out a program code of the program, and executes. In this case, the program and a computer-readable storage medium in which the program is stored construct the invention.

[0081] While the present invention is 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.

[0082] This application claims the benefit of Japanese Patent Application No 2012-279599 filed on Dec. 21, 2012, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. An image pickup apparatus having an image pickup unit configured to photograph an object image and obtain a photographed image, comprising:

an attitude detection unit configured to detect an attitude of the image pickup apparatus; and

a control unit configured to control on the basis of the attitude detected by the attitude detection unit when the photographing by the image pickup unit is performed, in such a manner that in a case where the image pickup apparatus is held vertically to photograph the image the photographed image is recorded to a recording medium without being rotated, and attitude information showing that the image pickup apparatus is held vertically is recorded as attribution information to the recording medium in association with the image, and in a case where the image is photographed by holding the image pickup apparatus upside down, the photographed image is recorded to the recording medium in a state in which the photographed image is rotated upside down.

2. An apparatus according to claim 1, wherein the control unit controls in such a manner that the image photographed by holding the image pickup apparatus upside down is recorded in the recording medium in a state in which the photographed image is rotated upside down, and attitude information showing that the image pickup apparatus is held upside down is not added.

3. An apparatus according to claim 1, wherein the control unit controls in such a manner that in the image photographed by the image pickup unit,

if it is determined that the attitude information indicates 0 degree, the image is recorded without being rotated and an attitude flag of 0 degree is added,

if it is determined that the attitude information indicates 90 degrees, the image is recorded without being rotated and an attitude flag of 90 degrees is added,

if it is determined that the attitude information indicates 180 degrees, the image is rotated by 180 degrees and recorded and the attitude flag of 0 degree is added, and

if it is determined that the attitude information indicates 270 degrees, the image is recorded without being rotated and an attitude flag of 270 degrees is added, and

wherein the added attitude information is recorded as the attribution information in association with the image.

4. An apparatus according to claim 1, wherein the attitude information is set in such a manner that

the attitude information is set to 0 degree for a state in which the image pickup apparatus is held in a normal positional state,

the attitude information is set to 90 degrees for a state in which the image pickup apparatus is rotated by 90 degrees and held vertically,

the attitude information is set to 180 degrees for a state in which the image pickup apparatus is held upside down, and

the attitude information is set to 270 degrees for a state in which the image pickup apparatus is rotated by 270 degrees and held vertically.

5. An apparatus according to claim 2, wherein the control unit controls in such a manner that with respect to the image photographed by rotating the image pickup apparatus by 270 degrees to hold vertically, the image is rotated by 180 degrees and the attitude flag of 90 degrees is added thereto, and the image is recorded in the recording medium.

6. An apparatus according to claim 1, wherein after a shutter button is fully depressed, the attitude detection unit executes an attitude discriminating process of the state in which the image pickup apparatus is held and outputs the attitude information.

7. An apparatus according to claim 1, wherein in a state in which a shutter button is in a half-depression state, the attitude detection unit executes an attitude discriminating process of the state in which the image pickup apparatus is held and outputs the attitude information.

8. An apparatus according to claim 1, wherein in a self-timer photographing, when there is an instruction to start a self-timer, the attitude detection unit executes an attitude discriminating process of the state in which the image pickup apparatus is held and outputs the attitude information.

9. An apparatus according to claim 1, wherein in a case where a moving image recording start operation is provided, at a point of time of the recording start of the moving image, the attitude detection unit executes an attitude discriminating process of the state in which the image pickup apparatus is held and outputs the attitude information.

10. An apparatus according to claim 1, wherein a display apparatus which is arranged to display a through image which is output from the image pickup unit is arranged on an apparatus main body through a close and open mechanism.

11. An image pickup apparatus having an image pickup unit configured to photograph an object image and obtain a photographed image, comprising:

an attitude detection unit configured to detect an attitude of the image pickup apparatus; and

a control unit configured to control on the basis of the attitude detected by the attitude detection unit when the photographing by the image pickup unit is performed, in such a manner that in a case where the image pickup apparatus is held vertically to photograph the image the photographed image is recorded to a recording medium without being rotated, and attitude information showing that the image pickup apparatus is held vertically is recorded as attribution information to the recording medium in association with the image, and in a case where the image is photographed by holding the image pickup apparatus upside down, the photographed image is recorded in the recording medium in a state in which the photographed image is rotated upside down, and attitude information showing that the image pickup apparatus is held upside down is not added.

12. A control method of an image pickup apparatus having an image pickup step of photographing an object image and obtaining a photographed image, comprising:

an attitude detection step of detecting an attitude of the image pickup apparatus; and

a control step of controlling on the basis of the attitude detected by the attitude detection unit when the photographing by the image pickup unit is performed, in such a manner that in a case where the image pickup apparatus is held vertically to photograph the image the photographed image is recorded to a recording medium without being rotated, and attitude information showing that the image pickup apparatus is held vertically is recorded as attribution information to the recording medium in association with the image, and in a case where the image is photographed by holding the image pickup apparatus upside down, the photographed image is recorded to the recording medium in a state in which the photographed image is rotated upside down.

13. A control method of an image pickup apparatus having an image pickup step of photographing an object image and obtaining a photographed image, comprising:

an attitude detection step of detecting an attitude of the image pickup apparatus; and

a control step of controlling on the basis of the attitude detected by the attitude detection unit when the photographing by the image pickup unit is performed, in such a manner that in a case where the image pickup apparatus is held vertically to photograph the image the photographed image is recorded to a recording medium without being rotated, and attitude information showing that the image pickup apparatus is held vertically is recorded as attribution information to the recording medium in association with the image, and in a case where the image photographed by holding the image pickup apparatus upside down, the photographed image is recorded to the recording medium in a state in which

the photographed image is rotated upside down, and attitude information showing that the image pickup apparatus is held upside down is not added.

14. A non-transitory computer-readable storage medium storing a program for causing a computer to execute a control method of an image pickup apparatus having an image pickup step of photographing an object image and obtaining a photographed image,

wherein the control method comprises:

an attitude detection step of detecting an attitude of the image pickup apparatus; and

a control step of controlling on the basis of the attitude detected by the attitude detection unit when the photographing by the image pickup unit is performed, in such a manner that in a case where the image pickup apparatus is held vertically to photograph the image the photographed image is recorded to a recording medium without being rotated, and attitude information showing that the image pickup apparatus is held vertically is recorded as attribution information to the recording medium in association with the image, and in a case where the image is photographed by holding the image pickup apparatus upside down, the photographed image is recorded to the recording medium in a state in which the photographed image is rotated upside down.

15. A non-transitory computer-readable storage medium storing a program for causing a computer to execute a control method of an image pickup apparatus having an image pickup step of photographing an object image and obtaining a photographed image,

wherein the control method comprises:

an attitude detection step of detecting an attitude of the image pickup apparatus; and

a control step of controlling on the basis of the attitude detected by the attitude detection unit when the photographing by the image pickup unit is performed, in such a manner that in a case where the image pickup apparatus is held vertically to photograph the image the photographed image is recorded to a recording medium without being rotated, and attitude information showing that the image pickup apparatus is held vertically is recorded as attribution information to the recording medium in association with the image, and in a case where the image is photographed by holding the image pickup apparatus upside down, the photographed image is recorded to the recording medium in a state in which the photographed image is rotated upside down, and attitude information showing that the image pickup apparatus is held upside down is not added.

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