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(12) **United States Patent**
Yoshida

(10) **Patent No.: US 11,948,605 B2**
(45) **Date of Patent: *Apr. 2, 2024**

(54) **RECORDING AND REPRODUCING APPARATUS AND METHOD THEREOF**

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(73) Assignee: **Maxell, Ltd.**, Kyoto (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
G11B 27/034 (2006.01)
G06F 16/73 (2019.01)

(Continued)

(52) **U.S. Cl.**
CPC ***G11B 27/034*** (2013.01); ***G06F 16/73*** (2019.01); ***G06F 16/745*** (2019.01); ***G06F 18/00*** (2023.01);

(Continued)

(58) **Field of Classification Search**
CPC G11B 27/34; G11B 27/105; G11B 27/28; G11B 27/30; H04N 5/77; H04N 5/772;

(Continued)

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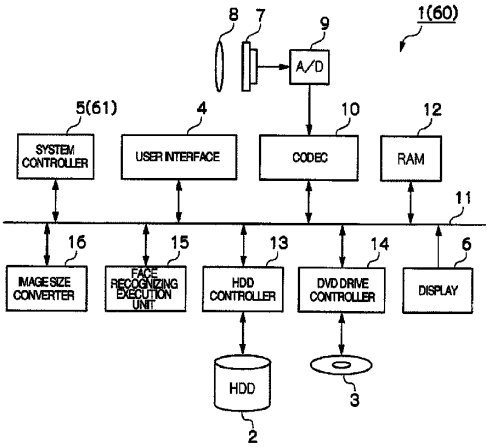
Primary Examiner — Mishawn N. Hunter

(74) *Attorney, Agent, or Firm* — Mattingly & Malur, PC

(57) **ABSTRACT**

In a recording and reproducing apparatus and a recording and reproducing method for the recording and reproducing apparatus for recording and reproducing image information on a scene obtained through photographing, relative to a predetermined first recording medium and being capable of setting one or more chapters to each scene, a face recognizing process is executed for a photographed image based on the image information, an importance level of each chapter is set in accordance with a result of the face recognizing process for a very important person (VIP) set by a user, and each chapter having a relevant importance level among importance levels of respective chapters is selectively reproduced. A user can therefore find an object chapter and scene quickly and easily.

20 Claims, 12 Drawing Sheets



Related U.S. Application Data

continuation of application No. 14/478,020, filed on Sep. 5, 2014, now Pat. No. 10,176,848, which is a continuation of application No. 12/430,185, filed on Apr. 27, 2009, now Pat. No. 9,159,368.

(51) **Int. Cl.**

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G06F 18/00	(2023.01)
G06V 20/40	(2022.01)
G06V 40/16	(2022.01)
G11B 27/10	(2006.01)
G11B 27/28	(2006.01)
G11B 27/30	(2006.01)
G11B 27/34	(2006.01)
H04N 5/77	(2006.01)
H04N 5/781	(2006.01)
H04N 5/85	(2006.01)
H04N 9/804	(2006.01)
H04N 21/434	(2011.01)

(52) **U.S. Cl.**

CPC ***G06V 20/40*** (2022.01); ***G06V 40/172*** (2022.01); ***G11B 27/105*** (2013.01); ***G11B 27/28*** (2013.01); ***G11B 27/30*** (2013.01); ***G11B 27/34*** (2013.01); ***H04N 5/77*** (2013.01); ***H04N 5/772*** (2013.01); ***H04N 5/781*** (2013.01); ***H04N 5/85*** (2013.01); ***H04N 9/8042*** (2013.01); *G11B 2220/455* (2013.01); *H04N 21/4347* (2013.01)

(58) **Field of Classification Search**

CPC H04N 5/781; H04N 5/85; H04N 9/8042; G06F 16/745; G06F 16/73; G06K 9/00; G06V 40/172; G06V 20/40

See application file for complete search history.

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FIG. 1

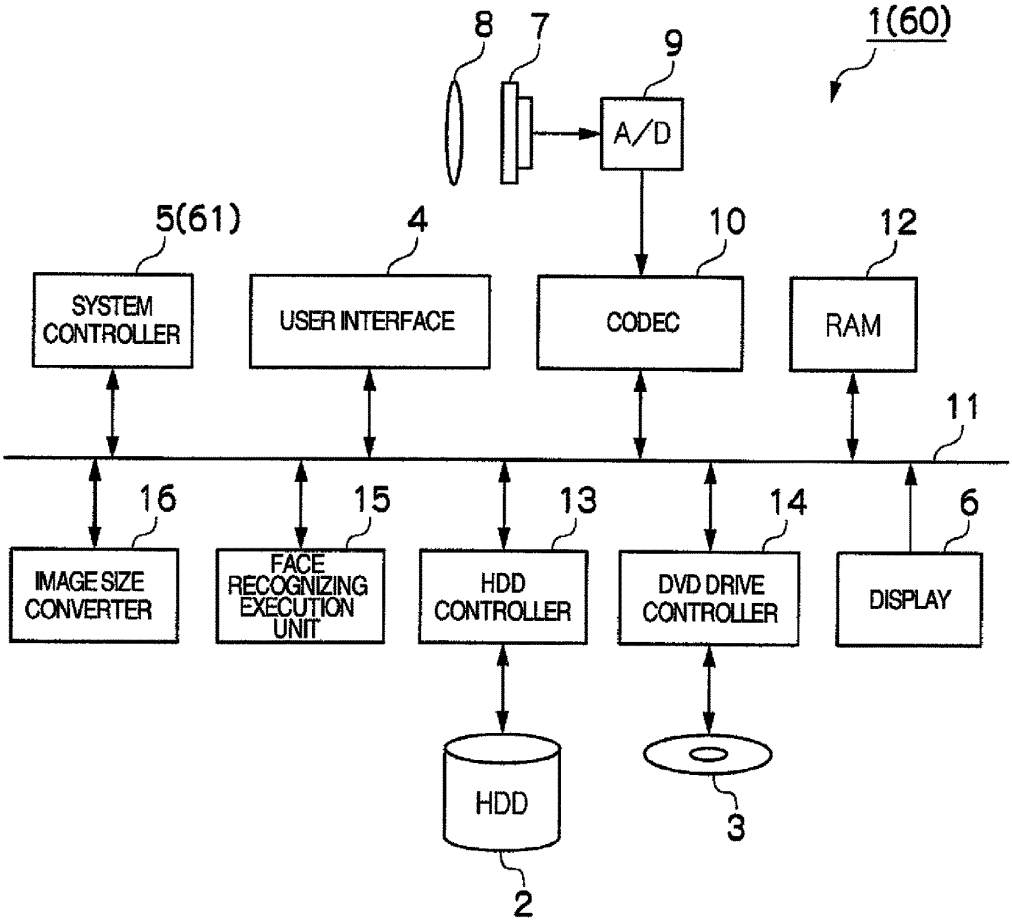

1(60)
8
7
9
A/D
5(61)
4
10
12
SYSTEM CONTROLLER
USER INTERFACE
CODEC
RAM
11
16
15
13
14
6
IMAGE SIZE CONVERTER
FACE RECOGNIZING EXECUTION UNIT
HDD CONTROLLER
DVD DRIVE CONTROLLER
DISPLAY
HDD
2
3

FIG. 2

21	22	23
001	hh:mm:ss:ff	2
002	hh:mm:ss:ff	1
003	hh:mm:ss:ff	3
⋮	⋮	⋮

20

FIG. 3

25	26	27
001	filepath/file. jpg	hh:mm:ss:ff •••
002	filepath/file. jpg	
003	filepath/file. jpg	hh:mm:ss:ff •••
⋮	⋮	

24

FIG. 4

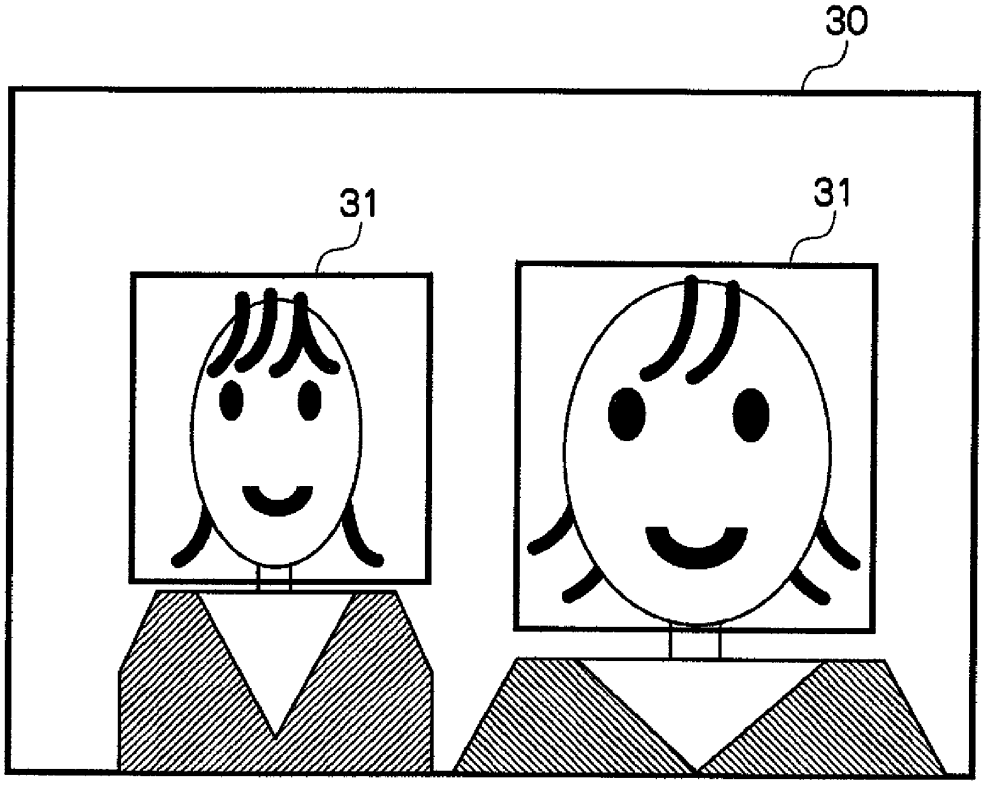


FIG. 5

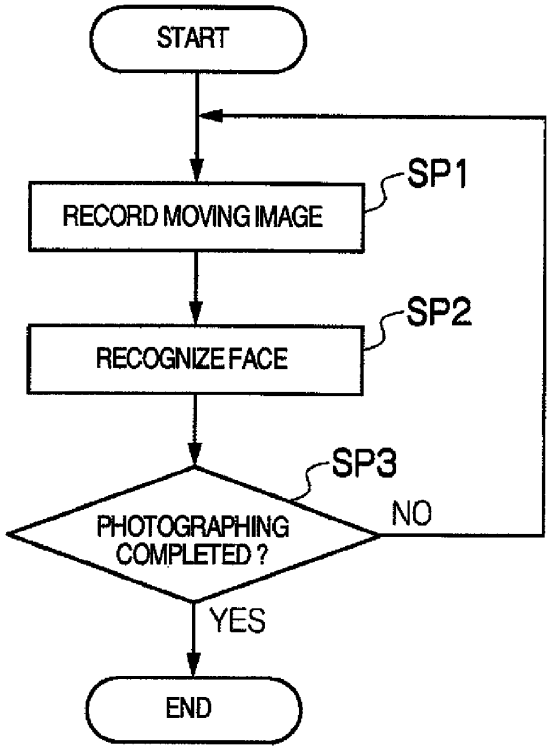

START
RECORD MOVING IMAGE
SP1
RECOGNIZE FACE
SP2
PHOTOGRAPHING COMPLETED ?
SP3
NO
YES
END

FIG. 6

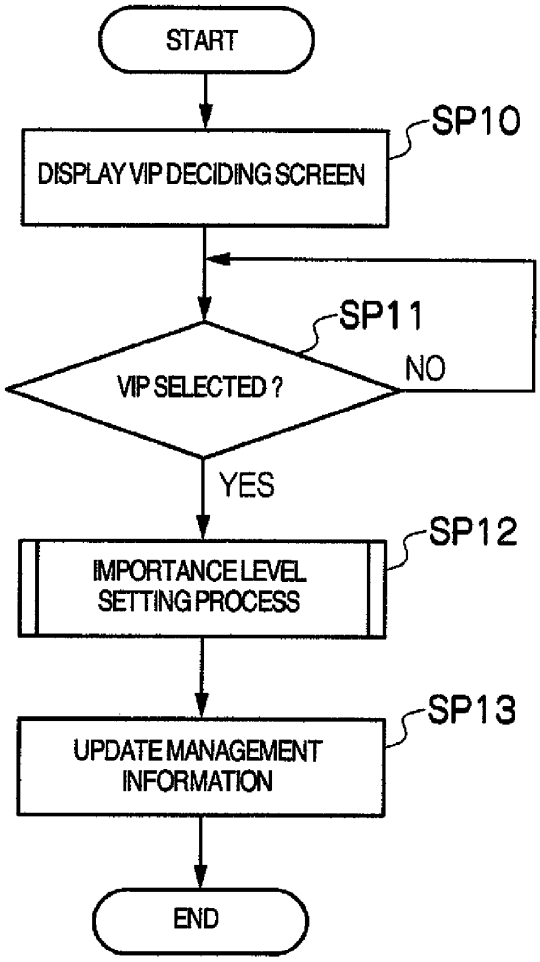

START
SP10
DISPLAY VIP DECIDING SCREEN
SP11
VIP SELECTED ?
NO
YES
SP12
IMPORTANCE LEVEL SETTING PROCESS
SP13
UPDATE MANAGEMENT INFORMATION
END

FIG. 7

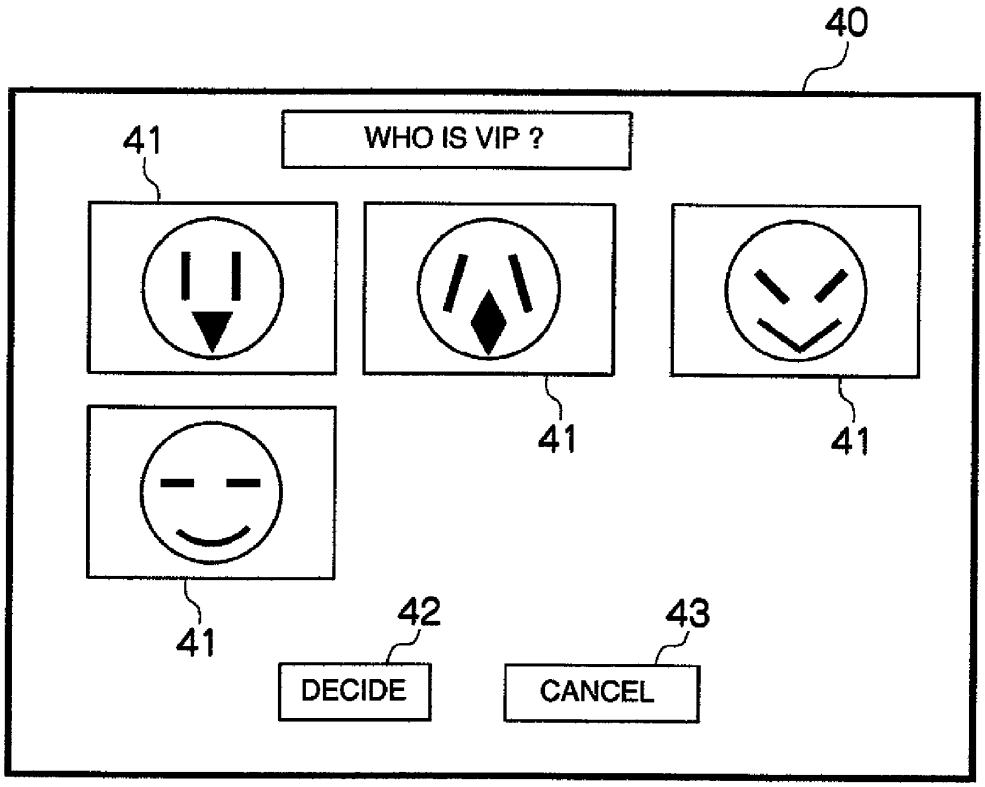


FIG. 8

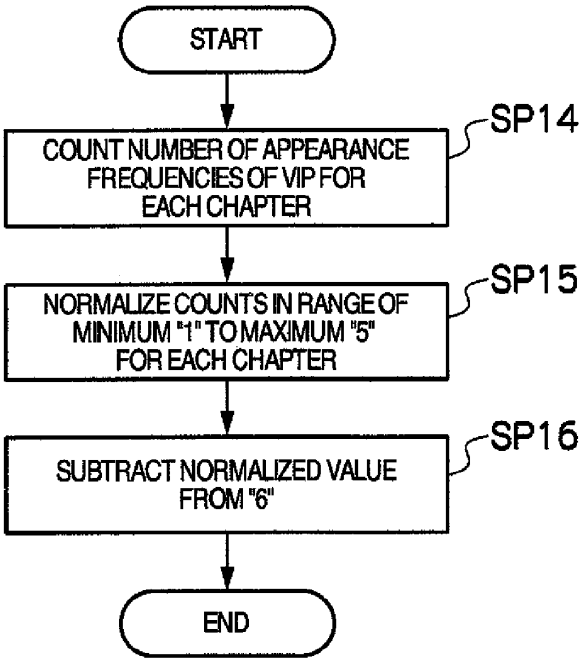


FIG. 9

CHAPTER ID	CHAPTER IMPORTANCE LEVEL
001	5
002	1
003	5
004	3
005	1
006	5
007	5
008	5
009	3

FIG. 10

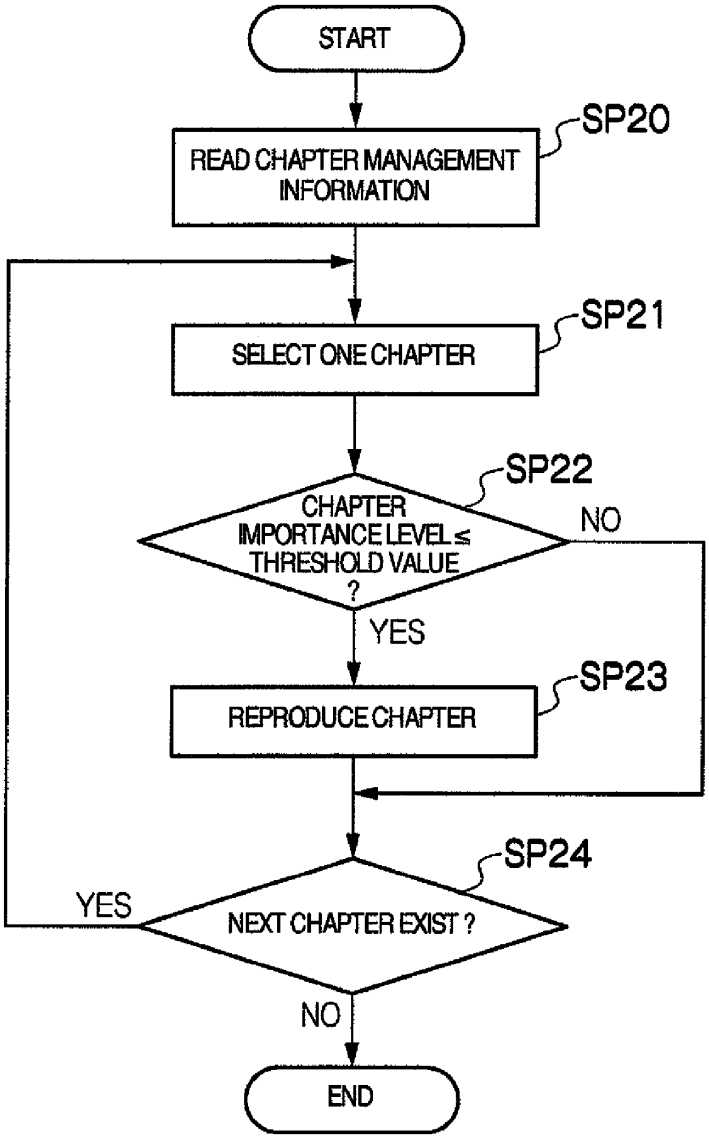
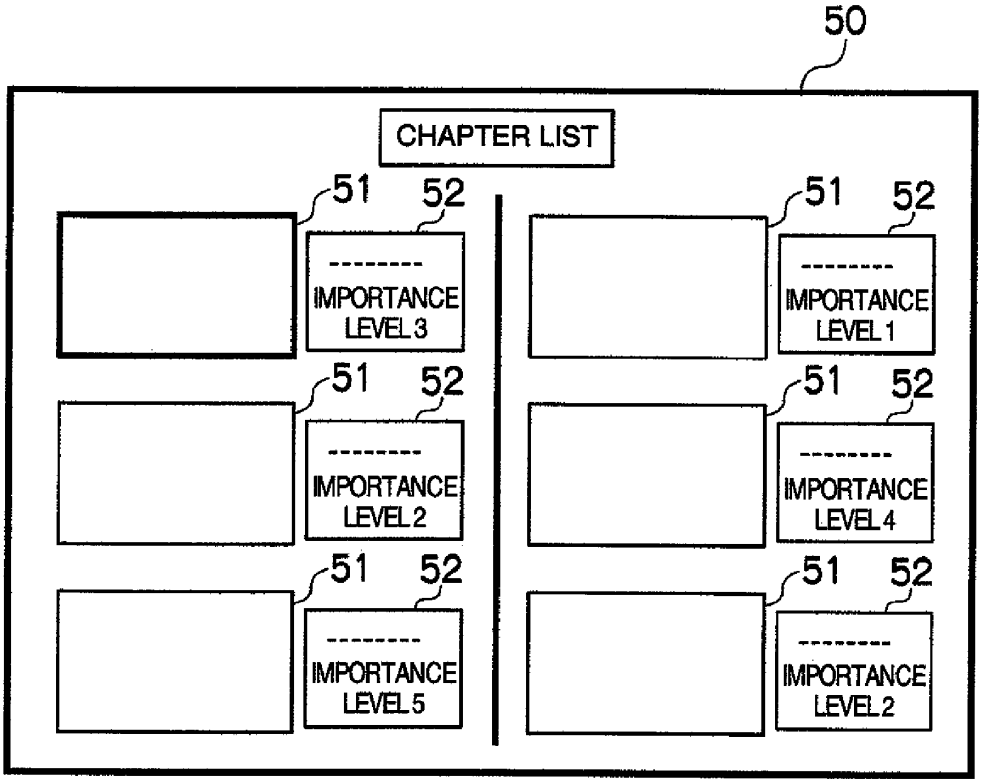

START
READ CHAPTER MANAGEMENT INFORMATION
SP20
SELECT ONE CHAPTER
SP21
CHAPTER IMPORTANCE LEVEL ≤ THRESHOLD VALUE ?
SP22
NO
YES
REPRODUCE CHAPTER
SP23
NEXT CHAPTER EXIST ?
SP24
YES
NO
END

FIG. 11


50
CHAPTER LIST
51
52

IMPORTANCE LEVEL 3
51
52

IMPORTANCE LEVEL 1
51
52

IMPORTANCE LEVEL 2
51
52

IMPORTANCE LEVEL 4
51
52

IMPORTANCE LEVEL 5
51
52

IMPORTANCE LEVEL 2

FIG. 12

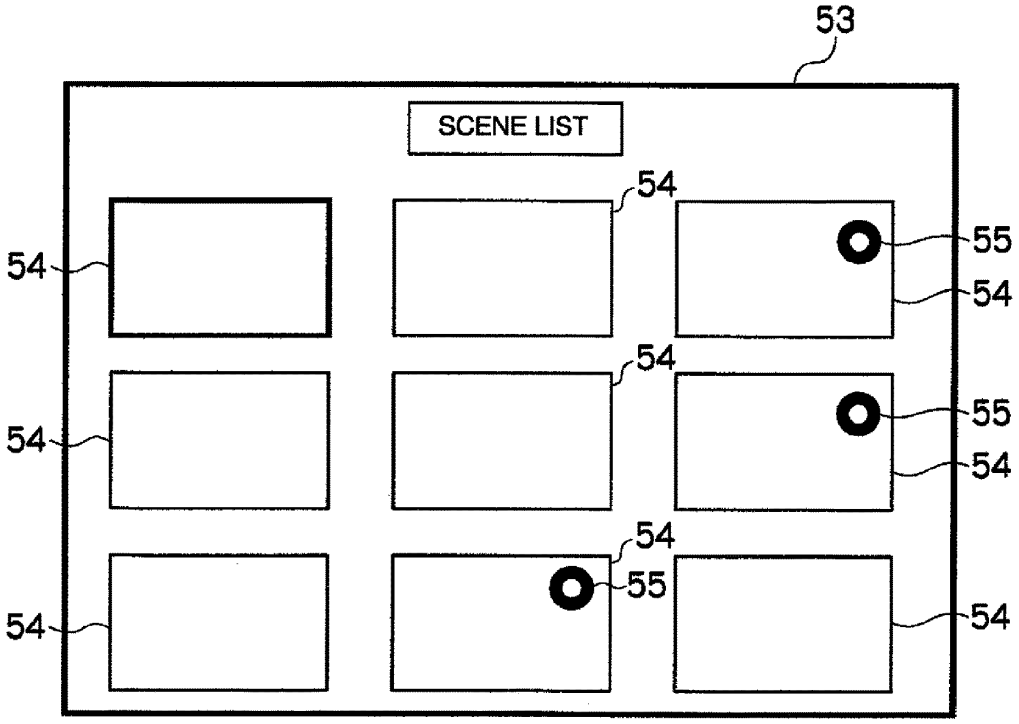


FIG. 13

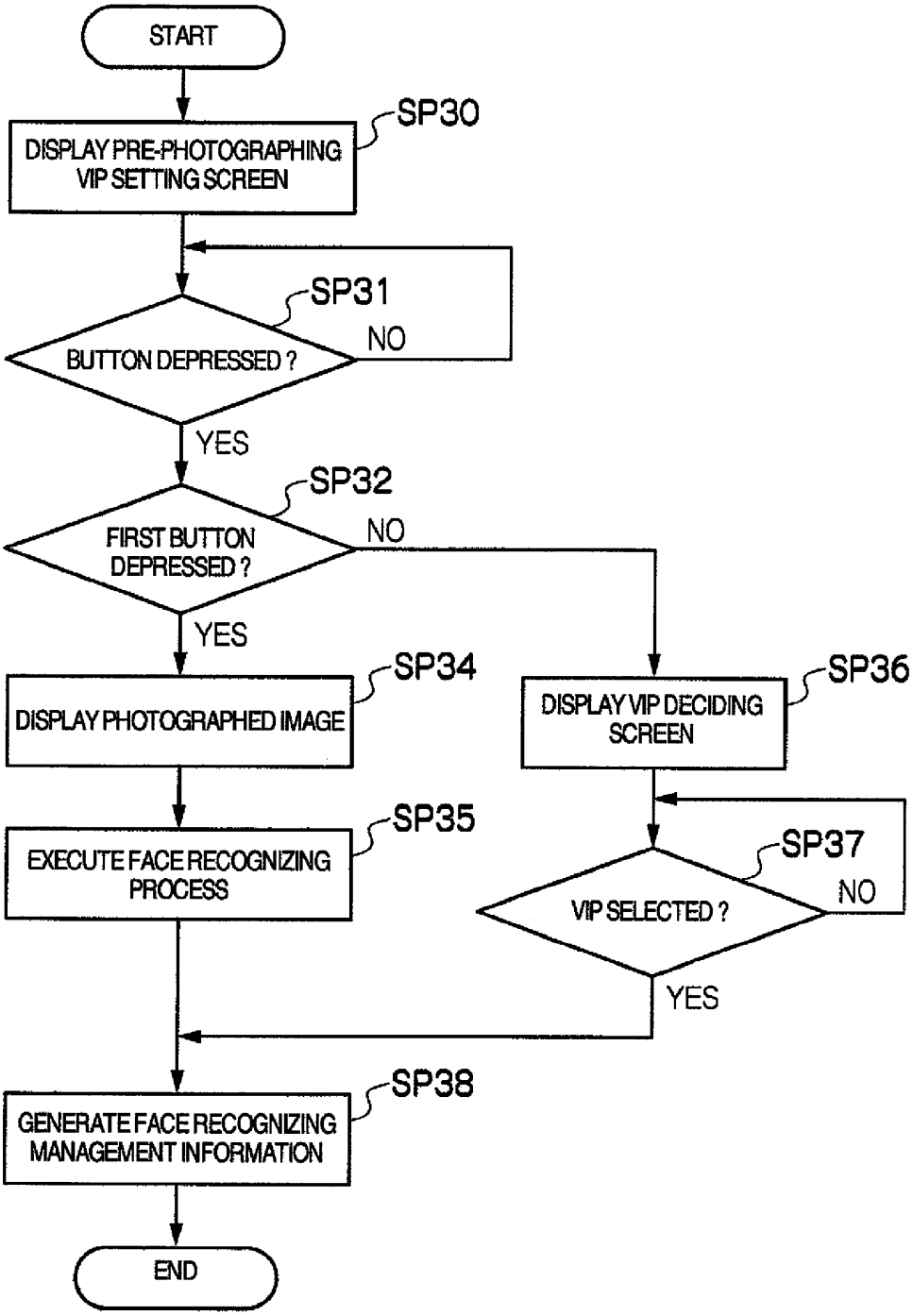

START
DISPLAY PRE-PHOTOGRAPHING VIP SETTING SCREEN
SP30
BUTTON DEPRESSED ?
SP31
NO
YES
FIRST BUTTON DEPRESSED ?
SP32
NO
YES
DISPLAY PHOTOGRAPHED IMAGE
SP34
DISPLAY VIP DECIDING SCREEN
SP36
EXECUTE FACE RECOGNIZING PROCESS
SP35
VIP SELECTED ?
SP37
NO
YES
GENERATE FACE RECOGNIZING MANAGEMENT INFORMATION
SP38
END

FIG. 14

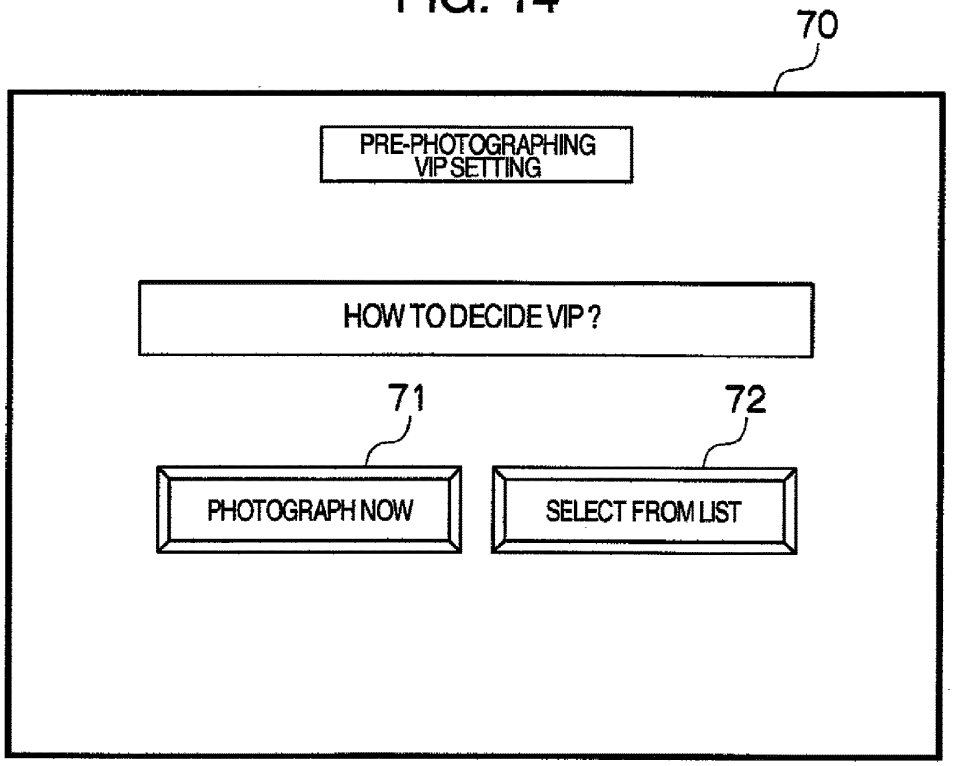
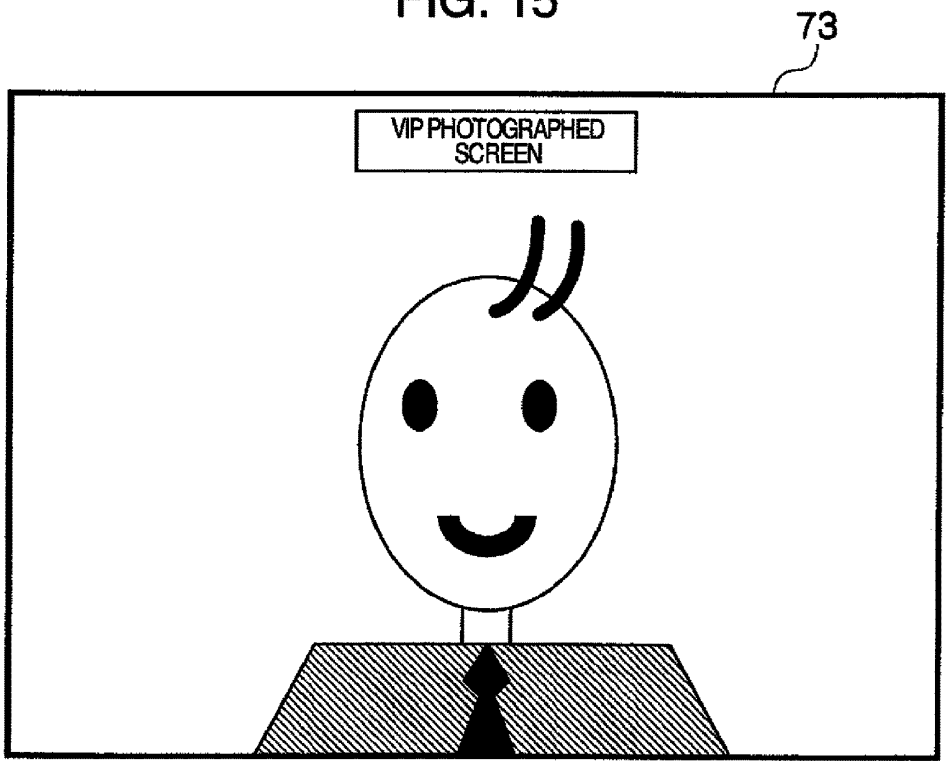

70
PRE-PHOTOGRAPHING VIP SETTING
HOW TO DECIDE VIP ?
71
72
PHOTOGRAPH NOW
SELECT FROM LIST

FIG. 15


73
VIP PHOTOGRAPHED SCREEN

RECORDING AND REPRODUCING APPARATUS AND METHOD THEREOF

INCORPORATION BY REFERENCE

This application is a continuation of application Ser. No. 15/898,351, filed Feb. 16, 2018, which is a continuation of application Ser. No. 14/478,020, filed Sep. 5, 2014, now U.S. Pat. No. 10,176,848, which is a continuation of application Ser. No. 12/430,185, filed on Apr. 27, 2009, now U.S. Pat. No. 9,159,368, which claims the benefit of Japanese Application No. JP 2008-130678 filed on May 19, 2008, in the Japanese Patent Office, the disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention related to a recording and reproducing apparatus and a recording and reproducing method, suitable for application to, e.g., a video camera.

In recent years, recording and reproducing apparatus are a widespread use which apparatus are compatible with randomly accessible recording media such as a digital versatile disc (DVD), a semiconductor memory and a hard disc drive (HDD). Such recording and reproducing apparatus can easily and quickly cue a photographed image recorded in a recording medium.

Of recording and reproducing apparatus of this type, for example, a general video camera manages generally video information of photographed images in the unit of scene, and cues each scene by using management information on each scene. A video camera of this type can set a plurality of chapters in one scene, and can cue each chapter.

A scene means a series of images recorded during a period from when a user depresses a record button to start photographing to when the user depresses again the record button to stop photographing. The number of scenes increases each time photographing is made upon depression of the record button. The chapter means a delimiter of images in one scene.

A user of a video camera can know quickly the contents of each scene by reproducing image information recorded in the recording medium by sequentially cuing each chapter.

However, if the number of chapters set in a scene is large, a user of the video camera is required to repeat a cue operation as many times as the number of chapters set in the scene, in order to confirm the contents to the last scene. There arises therefore a problem of much work and long time.

JP-A-06-165009 discloses techniques of efficiently knowing the contents of a scene by calculating a priority order of each frame from the type of button manipulation during photographing, and reproducing a frame having a higher priority order.

SUMMARY OF THE INVENTION

The capacity of a recording medium of a recent video camera is becoming large so that a scene photographed in a long time duration can be stored in the recording medium or scenes photographed a plurality of times can be stored in the recording medium. It is therefore difficult for a user to quickly find a target scene from a number of scenes recorded in the recording medium.

Some conventional recording and reproducing apparatus are equipped with a function of displaying a list of thumbnail images of scenes. However, this function displays only one

thumbnail image per one scene so that a user feels difficult in some cases to know the whole contents of a scene photographed in a long time duration from one thumbnail image. Further, after a lapse of long time after photographing, it is difficult for a user to remember the whole contents of a scene from one corresponding thumbnail image.

If a user cannot remember the contents of a scene even if the thumbnail image is viewed, the user confirms the contents of the scene by reproducing the scene. If the contents of a long time scene is to be confirmed, it becomes necessary to provide a function of confirming quickly the whole contents of the scene by cuing each chapter. However, this function has not been proposed yet.

JP-A-06-165009 discloses techniques of calculating a priority order of each frame from the type of button manipulation during photographing, and when digest reproduction for knowing the contents of a scene is to be performed, reproducing a frame having a higher priority order. According to the techniques, however, a priority degree cannot be set to a scene photographed without button manipulation by a user. It cannot be said that the techniques are easy to use.

The present invention has been made in consideration of the above-described issues, and provides a recording and reproducing apparatus and a recording and reproducing method allowing a user to rapidly and easily find a target chapter or scene.

In order to settle these issues, the present invention provides a recording and reproducing apparatus capable of setting one or more chapters to each scene, comprising: a recording and reproducing unit for recording and reproducing image information on the scene obtained through photographing, relative to a predetermined first recording medium; a face recognizing execution unit for executing a face recognizing process for a photographed image based on the image information; an importance level setting unit for setting an importance level of each chapter in accordance with a result of the face recognizing process for a very important person (VIP) set by a user; and a control unit for controlling the recording and reproducing unit so as to selectively reproduce each chapter having a relevant importance level, among importance levels of respective chapters.

Accordingly, the recording and reproducing apparatus of the present invention can selectively reproduce a particular chapter in accordance with user settings, such as a chapter on which a VIP appears frequently.

The present invention provides further a recording and reproducing method for a recording and reproducing apparatus for recording and reproducing image information on a scene obtained through photographing, relative to a predetermined first recording medium and being capable of setting one or more chapters to each scene, the method comprising: a first step of executing a face recognizing process for a photographed image based on the image information; a second step of setting an importance level of each chapter in accordance with a result of the face recognizing process for a VIP set by a user; and a third step of selectively reproducing each chapter having a relevant importance level, among importance levels of respective chapters.

Accordingly, the recording and reproducing method of the present invention can selectively reproduce a particular chapter in accordance with user settings, such as a chapter on which a VIP appears frequently.

According to the present invention, a user can therefore find an object chapter and scene quickly and easily.

Other objects, features and advantages of the invention will become apparent from the following description of the embodiments of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram illustrating the structure of a video camera according to first and second embodiments.

FIG. **2** is a conceptual diagram illustrating an example of chapter management information.

FIG. **3** is a conceptual diagram illustrating an example of face recognizing management information.

FIG. **4** is a conceptual diagram illustrating an example of a photographed image when face recognizing is made valid.

FIG. **5** is a flow chart illustrating the sequence of a photographed image recording process.

FIG. **6** is a flow chart illustrating the sequence of a chapter importance level setting process.

FIG. **7** is a brief diagrammatic view illustrating an example of the layout of a VIP determining screen.

FIG. **8** is a flow chart illustrating the sequence of an importance level determining process.

FIG. **9** is a table illustrating an example of the chapter arrangement of an object scene and a chapter importance level set to each chapter.

FIG. **10** is a flow chart illustrating the sequence of a chapter selecting and reproducing process.

FIG. **11** is a brief diagrammatic view illustrating an example of the layout of a chapter list screen.

FIG. **12** is a brief diagrammatic view illustrating an example of the layout of a scene list screen.

FIG. **13** is a flow chart illustrating the sequence of a VIP setting process.

FIG. **14** is a brief diagrammatic view illustrating an example of a layout of a pre-photographing VIP setting screen.

FIG. **15** is a brief diagrammatic view illustrating an example of the layout of a VIP photographing screen.

DESCRIPTION OF THE EMBODIMENTS

Embodiments of the present invention will now be described with reference to the accompanying drawings.

(1) First Embodiment

(1-1) Structure of Recording and Reproducing Apparatus

In FIG. **1**, reference numeral **1** represents a video camera of the embodiment. The video camera **1** is a hybrid video camera equipped with a DVD drive (not shown) and a built-in hard disc drive **2**. A DVD **3** to be mounted on the DVD drive includes a plurality of types such as DVD-R, DVD-RW, DVD-RAM, DVD+R, DVD+RW and HD (High Definition)-DVD. The type of DVD **3** applicable to the video camera **1** is not specifically limited.

In the video camera **1**, a user interface **4** is constituted of various operation buttons, a touch panel adhered to a screen of a display **6** to be described later. In accordance with a user operation command input from the user interface **4**, a system controller **5** executes a corresponding control process to record a photographed image in the hard disc drive **2** and DVD **3** loaded in the DVD drive and to reproduce a photographed image recorded in the hard disc drive **2** and DVD **3** and display the reproduced image on the display **6**.

The system controller **5** is actually a microcomputer constituted of a central processing unit (CPU), an internal memory and the like. When a record button in the user interface **4** is depressed after a record mode is selected upon operation of the user interface **4**, the system controller **5** drives an image sensor **7** constituted of a charge coupled device (CCD), complementary metal oxide semiconductor (CMOS) transistors and the like.

An optical image of an object is converged by a lens **8** on an optical reception plane of the image sensor **7**. The image sensor **7** photoelectrically converts the optical image, and sends an obtained photographed image signal to an analog/digital converter **9**. The analog/digital converter **9** converts the analog photographed image signal into a digital image signal, and sends the obtained digital information to a compressor/decompressor (CODEC) **10**.

CODEC **10** transfers the supplied image information to the display **6** via a bus **11**. The display **6** may be a liquid crystal display, an organic EL display or the like, and displays a photographed image (through image) basing upon the supplied image information.

CODEC **10** encodes the supplied image information by a predetermined compression encoding method such as a Moving Picture Expert Group (MPEG) method, and stores the obtained encoded image information, and the image information not subjected to encoding, in a random access memory (RAM) **12** via the bus **11**.

Under control of the system controller **5**, the encoded image information stored in RAM **12** is thereafter read by a hard disc drive controller **13** or a DVD drive controller **14**, and recorded in the hard disc drive **2** or DVD **3**.

The image information stored in RAM **12** is read by a face recognizing execution unit **15**. The face recognizing execution unit **15** executes a predetermined face recognizing process for the photographed image corresponding to the image information, and supplies the recognition results to the hard disc drive controller **13** or DVD drive controller **14** storing the encoded image information, as face recognizing management information to be described later. In this manner, the face recognizing management information is recorded in the hard disc drive **2** or DVD **3**, in correspondence with the encoded image information.

When a reproduction button of the user interface **4** is depressed after a reproduction mode is selected upon operation of the user interface **4**, the system controller **5** controls a corresponding one of the hard disc drive controller **13** and DVD drive controller **14** to make the hard disc drive controller **13** or DVD drive controller **14** read and transmit the encoded image information to CODEC **10** via the bus **11**.

Under control of the system controller **5**, CODEC **10** executes a predetermined decoding process for the encoded image information supplied from the hard disc drive controller **13** or DVD drive controller **14**, and transmits the obtained reproduced image information to the display **6** via the bus **11**. In this manner, a reproduced image corresponding reproduced image information is displayed on the display **6**.

An image size converter **16** is also connected to the bus **11**. Under control of the system controller **5**, the image size converter **16** extracts image information on a start frame of each scene and image information on a start frame of each chapter, from the image information stored in RAM **12** and image information read from the hard disk drive **2** or DVD **3** and decoded by CODEC **10**, for example, during photographing. The image size converter **16** converts the extracted image information into image information on thumbnail images of predetermined sizes, and stores the image infor-

mation on the thumbnail images of a start frame of the scene and a start frame of each chapter in the hard disc drive **2** or DVD **3** storing the encoded image information on the scene, in correspondence with the scene.

It is assumed that the video camera **1** has other hardware and functions of a general video camera, such as light emitting diodes (LED's) for turning on during power-on, charging, access to the hard disc drive **2** or DVD **3**, or the like, and batteries for supplying power to each circuit or the like.

In the following description, it is assumed that a photographed image is recorded in the hard disc drive **2** during photographing, and the photographed image is dubbed in DVD **3** after photographing. However, a photographed image may be recorded in DVD **3** during photographing, and the photographed image is dubbed in the hard disc drive **2** after photographing.

(1-2) Scene Management Information

During photographing with the video camera **1**, encoded image information as well as management information of each scene (hereinafter called scene management information) is recorded in the hard disc drive **2**. The scene management information is constituted of information for managing a scene such as chapter management information and face recognizing management information. The chapter management information includes information on a position, length, importance level, summary and the like of a start frame of each chapter. The face recognizing management information includes information on a position of a frame on which a face recognized by the face recognizing execution unit appears during photographing, an expression and size of the face on the frame, and the like.

FIG. **2** illustrates an example of the chapter management information. The chapter management information **20** illustrated in FIG. **2** is constituted of chapter ID information **21**, start frame position information **22** and chapter importance level information **23**, respectively of each chapter set in a scene.

The chapter ID information **21** is information representative of a unique ID given to each chapter (hereinafter called a chapter ID), and the start frame position information **22** is information representative of a position (hour, minute, second and frame number) of a start frame of the corresponding chapter. The chapter importance level information **23** is information representative of an importance level set to the corresponding chapter (herein after called a chapter importance level). The details of the chapter importance level will be described later. Under control of the system controller **5**, the chapter management information **20** is stored in the hard disc drive **2** in correspondence with the encoded image information of the scene.

FIG. **3** illustrates an example of the face recognizing management information. The face recognizing management information **24** illustrated in FIG. **3** is constituted of face ID information **25** for each face recognized in the corresponding scene, path/file name information **26** and frame position information **27**.

The face ID information **25** is information representative of a unique ID given to each face recognized by the face recognizing execution unit **15** (hereinafter called a face ID), and the path/file name information **26** is information representative of a path to the image file of an image of a corresponding face (hereinafter called a face image) or a file name of the image file. A face image to be stored in the image file may be an image captured when the person is recognized first in a frame, or an image capturing the best expression of the person in the scene after distinguishing a good expression such as smile during the face recognizing process.

The frame position information **27** is information representative of a frame position (hour, minute, second and frame number) where a corresponding face is recognized. The frame position information **27** includes all frame positions on which a corresponding face appears. Therefore, the number of frame positions contained in the frame position information **27** becomes larger the larger the number of times when the face (person) appears on the scene. A type of a face expression in a frame may be recorded in correspondence with each frame position.

As described above, the face recognizing execution unit **15** stores the face recognizing management information **24** in the hard disc drive **2** in correspondence with the encoded image information of a photographed image recorded at that time.

(1-3) Chapter Importance Level Setting Method

FIG. **4** illustrates an example of an image photographed by setting a face recognizing function "valid" and displayed on the display **6**. As the face recognizing function of the video camera **1** is set "valid", a rectangular frame **31** is displayed in a photographed image **30** displayed on the display **6**, surrounding a face of a person detected by the face recognizing function. As the face recognizing function is set "invalid", this frame **31** is not displayed.

FIG. **5** illustrates the contents of a process (hereinafter called a photographed image recording process) of recording an image photographed by setting the face recognizing function "valid" in the hard disc drive **2**, to be executed by the system controller **5**. The system controller **5** executes the photographed image recording process illustrated in FIG. **5** in accordance with a corresponding control program stored in the internal memory.

More specifically, as the record button of the user interface **4** is depressed after the record mode is selected, the system controller **5** starts the photographed image recording process. First, the analog/digital converter **9** and CODEC **10** are controlled to store image information of the photographed image and encoded image information in RAM **12**, and the hard disc drive controller **13** is controlled to read the encoded image information of one frame from RAM **12** and store the read encoded image information in the hard disc drive **2** (Step SP**1**).

Next, the system controller **5** controls the face recognizing execution unit **15** to read from RAM **12** the image information of the same frame as the frame whose encoded image information was read from RAM **12** by the hard disc drive controller **13** at Step SP**1** and execute the face recognizing process for the photographed image corresponding to the image information (Step SP**2**).

In this case, for example, the face recognizing execution unit **15** executes the face recognizing process by template matching, for example, using an average face. However, if a user forms a VIP list registering VIP's before photographing, the face recognizing process may be executed by template matching using the VIP list. After the face recognizing process is completed, the face recognizing execution unit **15** reflects the results of the face recognizing process upon the face recognizing management information described with reference to FIG. **3** (updating the face recognizing management information).

Next, the system controller **5** judges whether encoded image information of all frames obtained through photographing has been recorded in the hard disc drive **2** (Step SP**3**). If this judgment is negated, the flow returns to step SP**1**, and the system controller **5** repeats similar processes (SP**1** to SP**3**, to SP**1**).

If the judgment is affirmed at Step SP**3** after the encoded image information of all frames obtained through photographing is recorded in the hard disc drive **2**, the system controller **5** terminates the photographed image recording process.

The face recognizing process at Step SP**2** of the photographed image recording process may be executed for each frame as described above, or may be executed once for several frames. As the face recognizing process is executed once for several frames, a process load on the face recognizing execution unit **15** can be reduced.

A function (hereinafter called a post-photographing face recognizing function) may be provided allowing a face recognizing process to be executed for an image already photographed by setting the face recognizing function "invalid", through operation of a menu or the like. The face recognizing management process similar to that illustrated in FIG. **3** can be obtained by this function. With this post-photographing face recognizing function, a chapter importance level can be set using the face recognizing function as will be described later, even for a scene photographed with another video camera without the face recognizing function. This is very convenient for a user.

Next, description will be made on a method of determining an importance level of each chapter in one scene in accordance with the results (face recognizing management information **24** (FIG. **3**)) of the face recognizing process obtained in the manner described above.

It is assumed in the following that at least one chapter is set in each scene. A chapter forming method includes a method of making a user manually determine the position of each chapter, a method of automatically setting the position of each chapter where a luminance change is large in the scene, a method of automatically setting chapters at equal pitch of several minutes to several ten minutes, and other methods. In this embodiment, a chapter may be set by any one of these methods.

FIG. **6** illustrates the process contents of the system controller **5** regarding a chapter importance level setting function of setting an importance level of each chapter in a scene. As the user interface **4** is operated and a first screen display request is input, the system controller **5** executes a chapter importance level setting process illustrated in FIG. **6**, in accordance with a corresponding program stored in the internal memory (not shown).

More specifically, upon input of the first screen display request, the system controller **5** reads first the chapter management information **20** (FIG. **2**) and face recognizing management information **24** (FIG. **3**), stored in the hard disc drive **2**, of a scene to be processed at that time (hereinafter called an object scene), and displays a VIP deciding screen **40** illustrated in FIG. **7** on the display **6**, by using the chapter management information **20** and face recognizing management information **24** (Step SP**10**).

The VIP deciding screen **40** is a screen to be used for a user to decide a VIP in the object scene. The VIP deciding screen **40** displays face images **41** of all persons recognized during photographing the object scene. Each face image **41** is displayed in accordance with image data read from the image file identified by a corresponding path/file name information **26** (FIG. **3**) in the face recognizing management information **24** described with reference to FIG. **3**.

A user can select a VIP from the face images **41** of persons displayed on the VIP deciding screen **40**. A plurality of VIP's may be selected. Faces of objects having a high appearance frequency such as family members may be registered beforehand in the video camera **1** as a VIP list, and the faces of only the registered persons are displayed on the VIP deciding screen **40**. In this manner, since the face of a person not associated with the object and photographed in the background is not displayed, it becomes easy for a user to decide a VIP.

After the face image **41** of the person desired to be set as a VIP is selected by a predetermined operation, the user depresses a "decide" button **42** to register the selected person as a VIP. If an operation of deciding the chapter importance level is desired to be terminated, a "cancel" button **43** is depressed. If it is arranged in such a manner that a user can set whether such a VIP list is always used or not, user-friendliness of the video camera **1** can be improved.

Next, the system controller **5** stands by until a VIP is decided using the VIP deciding screen **40** (Step SP**11**). As the user decides a VIP, an importance level of each chapter of the object scene is determined in accordance with the decided VIP (Step SP**12**).

The system controller **5** reflects the importance level of each chapter decided at Step SP**12** upon the chapter management information **20** described with reference to FIG. **2** (Step SP**13**), to thereafter terminate the chapter importance level setting process.

FIG. **8** illustrates the specific process contents of the system controller **5** in the chapter importance level setting process at Step SP**12**.

In the chapter importance level setting process at Step SP**12**, the system controller **5** starts the importance level setting process. First, the number of appearance frequencies of the VIP decided by the user using the VIP deciding screen **40** (FIG. **7**) is counted for each chapter of the object scene (Step SP**14**).

More specifically, the system controller **5** prepares counters corresponding in number to the number of chapters in the scene, on the inner memory of the system. The system controller **5** reads the positions of all frames on which the VIP decided by the user using the VIP deciding screen **40** appears, from the face recognizing management information **24** (FIG. **3**), by using a face ID of the VIP, and judges to which chapter each frame belongs, by referring to the chapter management information **20** (FIG. **2**). In accordance with the judgment results, the system controller **5** increments by "1" the count of the counter corresponding to the chapter to which the frame belongs, for each frame on which the VIP appears. The system controller **5** executes these processes for all VIP's decided by the user using the VIP deciding screen **40**.

Next, the system controller **5** normalizes the counts of the counters in a range from "1" to "5" (Step SP**15**), and decides a value obtained by subtracting each normalized value from "6", as an importance level of each chapter corresponding to the counter (Step SP**16**).

With these processes, the highest chapter importance level of "1" is set to the chapter on which the VIP appears most frequently, and the lowest chapter importance level of "5" is set to the chapter on which the VIP appears least frequently. Thereafter, the system controller **5** terminates this importance level deciding process and returns to the chapter importance level setting process.

If a user selects a plurality of VIP's on the VIP deciding screen **40**, the chapter importance levels may be weighted to allow the user to set more important persons. User-friendliness of the video camera **1** can therefore be improved further.

(1-4) Reproducing Method Using Chapter Importance Level

Next, description will be made on an object scene reproducing method basing upon the chapter importance level of each chapter set in the manner described above. It is assumed in the following description that the chapter importance level is set in five steps, "1" being the highest chapter importance level, and "5" being the lowest chapter importance level. In the following, the chapter importance levels are distinguished for the purposes of convenience by calling the chapter importance level "1" superexpress, the chapter importance level "3" express, and the chapter importance level "5" standard.

FIG. **9** illustrates an example of the chapter structure of an object scene and a chapter importance level set to each chapter. In the example illustrated in FIG. **9**, the object scene is divided into nine chapters having chapter ID's of "001" to "009". The chapter importance level "1" is set to two chapters having the chapter ID's "002" and "005", the chapter importance level "3" is set to two chapters having the chapter ID's "004" and "009", and the chapter importance level "5" is set to the remaining chapters having the chapter ID's "001", "003", "006" to "008".

In this example, as reproduction is performed by selecting as a reproducing mode a "standard reproducing mode" from the menu, all chapters are sequentially reproduced in an order of smaller chapter ID, irrespective of the chapter importance level set to each chapter. Namely, in the "standard reproducing mode", the chapters having the chapter importance level "5" or smaller (the chapters having the chapter importance levels "1" to "5", i.e., all chapters) are reproduced in this mode of the embodiment.

Further, as a user starts reproducing by selecting as the reproducing mode an "express reproducing mode", the video camera **1** reproduces first the chapter having the chapter importance level "1" and chapter ID "002", then the chapter having the chapter importance level "3" and the chapter ID "004", and next the chapter having the chapter importance level "1" and the chapter ID "005". Lastly, the video camera **1** reproduces the chapter having the importance level 3 and the chapter ID "009" to thereafter terminate scene reproducing. Namely, in the express reproducing mode", only the chapters having the chapter importance level "3" or smaller (only the chapters having the importance levels "1" to "3") are reproduced. Therefore, as cue skipping is performed during reproducing in the "express reproducing mode", reproducing starts from the start frame of the next chapter having the chapter importance level "3" or smaller.

Furthermore, as a user starts reproducing by selecting as the reproducing mode a "superexpress reproducing mode", the video camera **1** reproduces first the chapter having the chapter importance level "1" and chapter ID "002", then the chapter having the chapter importance level "1" and the chapter ID "005" to thereafter terminate scene reproducing. Namely, in the "super express reproducing mode", only the chapters having the chapter importance level "1" are reproduced.

Therefore, the video camera **1** reproduces always the chapter having the chapter importance level "1" as any of the reproducing modes is selected, and each of other chapters is reproduced only when the reproducing mode is selected reproducing the chapter having the chapter importance level same as or smaller than that set to each of other chapters.

By utilizing this function (hereinafter called a chapter select reproducing function), the superexpress reproducing mode is used for confirming roughly the contents of the object scene, and at the stage when reproducing comes near the images whose contents are desired to be confirmed in detail, the reproducing mode is switched to the standard reproducing mode. In this manner, the contents of the object scene can be confirmed efficiently and conveniently. The superexpress reproducing mode is very convenient for a user desiring to confirm the contents of a scene in short time.

FIG. **10** illustrates the process contents of the system controller **5** regarding the chapter select reproducing function. The system controller **5** executes the chapter select reproducing process illustrated in FIG. **10** in accordance with a control program stored in the internal memory.

Namely, as a reproducing operation start command is input after the "standard reproducing mode", "express reproducing mode" or "superexpress reproducing mode" is selected, the system controller **5** starts the chapter select reproducing process to first read the chapter management information of the object scene from a corresponding hard disc drive **2** or DVD **3** (Step SP**20**).

Next, in accordance with the ID information contained in the chapter management information, the system controller **5** selects the first chapter (e.g., the chapter having the smallest chapter ID) (Step SP**21**), and judges whether the chapter importance level of the chapter is a predetermined threshold value or smaller set to the present reproducing mode (Step SP**22**). The threshold value is "5" if the "standard reproducing mode" is set, "3" if the "express reproducing mode" is set, and "1" if the "superexpress reproducing mode" is set.

If a judgment at Step SP**22** is negated, the flow advances to Step S**24**, whereas if the judgment is affirmed, the system controller **5** controls CODEC **10** to reproduce the chapter and display the reproduced image on the display (Step SP**23**).

Next, the system controller **5** refers to the chapter management information to judge whether the chapter next to the chapter selected at Step SP**21** exists (Step SP**24**). If this judgment is affirmed, the flow returns to Step SP**21** to repeat similar processes by sequentially switching the chapter to be selected at Step SP**21** (Steps SP**21** to SP**24**, to SP**21**).

As the processes at Steps SP**21** to SP**24** are completed for all chapters and the judgment at Step SP**24** is negated, the system controller **5** terminates the chapter select reproducing process.

Next, description will be made on an approach to making a user to easily confirm the chapter importance level set to each chapter in a scene.

FIG. **11** illustrates a chapter list screen **50** displayed on the display **6** by a user menu operation. For each chapter of an object scene, a thumbnail image **51** set to the chapter, and chapter management information **52** such as a lapse time from the scene start, a chapter importance level and the like, are displayed on the chapter list screen **50**.

More practically, when a display command for the chapter list screen **50** is input by operating the user interface **4**, the system controller **5** controls a corresponding hard disc drive controller **13** or DVD drive controller **14** to read from the hard disc drive **2** or DVD **3** the chapter management information **20** (FIG. **2**) of the object scene, and the image information on the thumbnail image **51** of the start frame of

each chapter stored in correspondence with the object scene. Then, the system controller **5** operates to display the thumbnail image **51** of the start frame of each chapter on the chapter list screen **50** in accordance with the read image information, and display the management information **52** of each chapter based on the chapter management information **20**, on the chapter list screen **50**, in correspondence with the thumbnail image **51**.

In this manner, a user can know the chapter having a high chapter importance level from the chapter list screen **50**, and can find an important image quickly.

Next, description will be made on an approach to making a user easily confirm a scene set with a chapter importance level.

FIG. **12** illustrates a scene list screen displayed on the display by a user menu operation. A thumbnail image **54** of each scene stored in the hard disc drive **2** or DVD **3** is displayed on the scene list screen **53**.

More practically, when a display command for the scene list screen **53** is input by operating the user interface **4**, the system controller **5** controls a corresponding hard disc drive controller **13** or DVD drive controller **14** to read from the hard disc drive **2** or DVD **3** the image information on the thumbnail image **54** of the start frame of every scene stored in the hard disc drive **2** or DVD **3** designated by the user. Then, the system controller **5** operates to display the thumbnail image **54** of the start frame of each scene on the scene list screen **53**, in accordance with the read image information.

In this case, the system controller **5** refers to the chapter management information **20** (FIG. **2**) of each scene, and displays an icon **55** having a predetermined shape on the thumbnail image **54** of the scene set with the chapter importance level.

It is therefore possible for a user to judge from the icon **55** whether a chapter importance level is set to the scene, for example, to be reproduced. The contents of the scene displayed with the icon **55** can be confirmed efficiently by immediately performing a reproducing operation by the reproducing method using the chapter importance level as described above. For the scene not displayed with the icon, the chapter importance level setting process is executed before the reproduction operation so that the reproducing operation by the above-described reproducing method can be performed.

(1-5) Scene Dubbing Process

Next, description will be made on a process of dubbing encoded image information recorded in the hard disc drive **2** into DVD **3**.

When the scene set with the chapter importance level is dubbed from the hard disc drive **2** into DVD **3** in the video camera **1**, the system controller **5** copies not only the encoded image information and scene management information (chapter management information **20** (FIG. **2**) and face recognizing management information **24** (FIG. **3**) but also an image file of face images of faces registered in the face recognizing management information **24** contained in the scene management information, into DVD **3**. Therefore, even if the encoded information in the hard disc drive **2** is erased, reproducing using a chapter importance level and re-setting a chapter importance level can be performed immediately.

(1-6) Effects of the Embodiment

According to the video camera of the embodiment described above, the chapter importance level of each chapter can be set basing upon the results of the face recognizing process executed during photographing. It is therefore possible for a user to quickly find a chapter on which an object person (VIP) appears frequently. Further, a chapter having a relevant chapter importance level is selectively reproduced, among chapter importance levels of respective chapters, so that a user can confirm the whole contents of the scene easily and in short time and can find an object scene quickly. In this manner, user-friendliness of the video camera **1** can be improved considerably.

(2) Second Embodiment

In FIG. **1**, reference numeral **60** represents a video camera of the second embodiment. The video camera **60** of the second embodiment is configured like the video camera **1** of the first embodiment, excepting that the chapter importance level setting method is different from that of the first embodiment.

Namely, in the first embodiment, a user decides a VIP by using the VIP deciding screen **40** (FIG. **7**) after photographing, and in accordance with the decision, a chapter importance level of each chapter is set. In contrast, in the second embodiment, the face recognizing process is executed only for a VIP decided by a user before photographing, and in accordance with the results of the face recognizing process, a chapter importance level of each chapter is set.

FIG. **13** illustrates the process contents of the system controller regarding a VIP setting process for a user to set a VIP before photographing, in the chapter importance setting method of the second embodiment. The system controller **61** executes the VIP setting process in accordance with a control program stored in the inner memory (not shown).

Namely, when a VIP setting mode is selected by operating the user interface **4**, the system controller **61** starts the VIP setting process to first display a pre-photographing VIP setting screen **70** illustrated in FIG. **14** on the display **6** (Step SP**30**).

Next, the system controller **61** stands by until one of first and second VIP deciding method select buttons **71** and **72** displayed on the pre-photographing VIP setting screen **70** (Step SP**31**) is depressed. The first VIP deciding method select button **71** is a button corresponding to a mode of preparing for photographing a VIP, and the second VIP deciding method select button **72** is a button corresponding to a mode of deciding a VIP among persons recognized during photographing already performed, similar to the first embodiment.

As one of the first and second VIP deciding method select buttons **71** and **72** is depressed, the system controller **61** judges whether the depressed button is the first VIP deciding method select button **71** (Step SP**32**).

As this judgment is affirmed, the system controller **61** drives the image sensor **7**, analog/digital converter **9** and CODEC **10** to display an image illustrated in FIG. **15** and photographed at that time by a user, on the display **6** (Step SP**34**). In this case, the user photographs a VIP to be registered with the video camera **60**.

Next, during photographing a VIP, the system controller **61** drives the face recognizing execution unit **15** to execute the face recognizing process for the VIP under photographing (Step SP**35**). After completion of the face recognizing process, the system controller **61** makes the face recognizing execution unit **15** form the face recognizing management information **24** (FIG. **3**) based upon the face recognizing process results, and store this information in the hard disc

drive **2** (Step SP**38**). Thereafter, the system controller **61** terminates the VIP setting process.

If the judgment at Step SP**32** is negated (i.e., if the second VIP deciding method select button **72** is depressed), the system controller **61** displays the VIP display screen **40** described with reference to FIG. **7** on the display **6** (Step SP**36**).

Next, the system controller **61** stands by until a VIP is selected from the VIP display screen **40** (Step SP**37**). As a VIP is selected, the face recognizing execution unit **15** is instructed to form the face recognizing management information **24** illustrated in FIG. **3** registering only information on the selected VIP (Step SP**38**). Thereafter, the system controller **61** terminates the VIP setting process.

With this arrangement, the system controller **61** controls the face recognizing execution unit **15** to reflect only the results of the face recognizing process for the VIP registered in the manner described above, upon the face recognizing management information (FIG. **3**), during photographing. Each time scene photographing is completed, the importance level setting process described with reference to FIG. **8** is executed to determine a chapter importance level of each chapter set in the scene, and in accordance with the determined chapter importance level, the chapter management information **20** (FIG. **2**) is updated.

As described above, the video camera **60** of the embodiment executes the face recognizing process only for a VIP decided before moving image photographing, and in accordance with the results of the face recognizing process, a chapter importance level of each chapter is set. It is therefore possible to facilitate setting of the chapter importance level of each chapter. Further, since the video camera **60** registers a VIP in advance as described above, it is possible to avoid the following phenomenon. Namely, in performing autofocus and autoexposure utilizing face recognition, if the face of another person photographed together with a VIP is recognized by chance, the optimum focus and exposure are set to this other person, and the object VIP is not photographed well.

(3) Other Embodiments

In the first and second embodiments, the present invention is applied to the video camera **1**, **60** configured as illustrated in FIG. **1**. The present invention is not limited thereto, but is also applicable to video cameras having various structures, apparatus other than video cameras such as DVD recorders, electronic still cameras and mobile phones provided with a moving image photographing function.

Further, in the first and second embodiments, although the hard disc drive **2** and DVD **3** are adopted as recording media for recording photographed images, the present invention is not limited thereto, but recording media other than the DVD and hard disc drive may also be adopted including a Blu-ray disc (BD), a compact disc (CD), a mini disc (MD), a semiconductor memory and the like.

Furthermore, in the first and second embodiments, although the hard disc drive **2** and a DVD drive as the recording/reproducing unit for recording and reproducing image information on photographed scenes relative to recording media are built in the video camera **1**, **60**, the present invention is not limited thereto, but may adopt an external mount type drive connected by USB (Universal Serial Bus), eSATA (External Serial Advanced Technology Attachment) and the like as the recording and reproducing unit.

Still further, in the first and second embodiments, although one system controller **5**, **61** is constituted of: an importance level setting unit for setting a chapter importance level of each chapter in accordance with the results of a face recognizing process for a VIP set by a user; a controller for controlling the hard disc drive **2** and DVD drive so as to selectively reproduce a chapter having a relevant importance level, among importance levels of respective chapters; and a VIP setting unit for setting as a VIP a person corresponding to a face image selected by a user from a list of face images displayed on the display, the present invention is not limited thereto, but the importance level setting unit, control unit and VIP setting unit may be structured discretely.

The present invention is widely applicable to various recording and reproducing apparatus such ad DVD recorders in addition to video cameras.

The preferred embodiments of the present invention have been described above. According to the present invention, a particular chapter can be selectively reproduced in accordance with user settings so that a user can find quickly a chapter on which a desired person appears. Further, since a particular chapter based on user settings can be selectively reproduced, a user can know the whole contents of a scene in short time and easily.

It should be further understood by those skilled in the art that although the foregoing description has been made on embodiments of the invention, the invention is not limited thereto and various changes and modifications may be made without departing from the spirit of the invention and the scope of the appended claims.

The invention claimed is:

1. A recording and reproducing apparatus for recording and reproducing image information, comprising:

a photographing sensor configured to photograph an object and generate image information to be stored in an internal recording medium or an external recording medium;

a reproducer configured to reproduce the image information stored in the internal recording medium or the external recording medium;

processing circuitry configured to:

execute a face-recognizing process on the image information generated by the photographing sensor to detect a face;

register a person in the image information as a specific person, wherein a first person with a face is obtained by newly photographing the first person in a photographing mode and thereafter registered as a first specific person, and wherein a second person with a face is obtained by newly photographing the second person in a photographing mode and thereafter registered as a second specific person;

firstly pick out image information which includes both the registered first specific person and the registered second specific person based on selection of thumbnail images being displayed simultaneously corresponding to each of the registered first specific person and the registered second specific person, the thumbnail images extracting and indicating face area of each of the registered first specific person and the registered second specific person,

secondly pick out the image information based on a predetermined condition from among the picked-out image information which includes both the registered first specific person and the registered second specific person, and

control the reproducer to selectively and sequentially reproduce the image information picked out based on the predetermined condition.

2. The recording and reproducing apparatus according to claim **1**,

wherein the processing circuitry is further configured to control the reproducer to selectively and sequentially reproduce the image information picked out based on the predetermined condition in a reproducing mode set from one of a first reproducing mode and a second reproducing mode, and

wherein a reproducing time required for reproducing the image information under the first reproducing mode is shorter than a reproducing time required for reproducing the image information under the second reproducing mode, and the image information reproduced under the second mode includes the image information reproduced under the first reproducing mode and other of the image information not reproduced under the first reproducing mode.

3. The recording and reproducing apparatus according to claim **2**,

wherein the processing circuitry is further configured to control the reproducer to selectively and sequentially reproduce the image information picked out based on the predetermined condition in the reproducing mode set from one of the first reproducing mode, the second reproducing mode, and a third reproducing mode, and

wherein a reproducing time required for reproducing the image information under the third reproducing mode is longer than the reproducing time required for reproducing the image information under the second reproducing mode.

4. The recording and reproducing apparatus according to claim **1**,

wherein the recording medium further stores instructions that, when executed by the processing circuitry, cause the processing circuitry to execute the face-recognizing process on image information captured from an external camera not included in the recording and reproducing apparatus.

5. The recording and reproducing apparatus according to claim **1**, further comprising

a display,

wherein, in response to the face-recognizing process detecting that a face of a person is included in video information generated by the photographing sensor, the display displays the video information with a frame surrounding at least a portion of the face of the person.

6. The recording and reproducing apparatus according to claim **5**,

wherein the frame is a rectangular frame.

7. The recording and reproducing apparatus according to claim **1**,

wherein the processing circuitry is further configured to generate a thumbnail corresponding to the recorded image information such that the thumbnail is displayed on the display with an icon having a predetermined shape when an importance level is set for the recorded image information via a user interface.

8. The recording and reproducing apparatus according to claim **7**,

wherein the icon is displayed on the thumbnail.

9. The recording and reproducing apparatus according to claim **1**,

wherein the predetermined condition is set in accordance with an instruction by a user.

10. The recording and reproducing apparatus according to claim **1**,

wherein the thumbnail images are displayed side by side together with an other thumbnail indicating face region including a third face extracted from a third specific person included in the image information which is different from the first specific person and the second specific person.

11. A recording and reproducing method for recording and reproducing image information, comprising:

photographing, by a photographing sensor, an object and generating image information to be stored in an internal recording medium or an external recording medium;

reproducing, by a reproducer, the image information stored in the internal recording medium or the external recording medium;

executing, by processing circuitry, a face-recognizing process on the image information generated by the photographing sensor to detect a face;

registering, by processing circuitry, a person in the image information as a specific person, wherein a first person with a face is obtained by newly photographing the first person in a photographing mode and thereafter registered as a first specific person, wherein a second person with a face is obtained by newly photographing the second person in a photographing mode and thereafter registered as a second specific person;

firstly, selecting, by processing circuitry, image information which includes both the registered first specific person and the registered second specific person based on selection of thumbnail images being displayed simultaneously corresponding to each of the registered first specific person and the registered second specific person, the thumbnail images extracting and indicating face area of each of the registered first specific person and the registered second specific person,

secondly, selecting, by processing circuitry, the image information based on a predetermined condition from among the selected image information which includes both the registered first specific person and the registered second specific person, and

controlling, by processing circuitry, the reproducer to selectively and sequentially reproduce the image information selected based on the predetermined condition.

12. The recording and reproducing method according to claim **11**,

wherein the processing circuitry is further configured to control the reproducer to selectively and sequentially reproduce the image information picked out based on the predetermined condition in a reproducing mode set from one of a first reproducing mode and a second reproducing mode, and

wherein a reproducing time required for reproducing the image information under the first reproducing mode is shorter than a reproducing time required for reproducing the image information under the second reproducing mode, and the image information reproduced under the second mode includes the image information reproduced under the first reproducing mode and other of the image information not reproduced under the first reproducing mode.

13. The recording and reproducing method according to claim **12**,

wherein the processing circuitry is further configured to control the reproducer to selectively and sequentially reproduce the image information picked out based on the predetermined condition in the reproducing mode

set from one of the first reproducing mode, the second reproducing mode, and a third reproducing mode, and

wherein a reproducing time required for reproducing the image information under the third reproducing mode is longer than the reproducing time required for reproducing the image information under the second reproducing mode.

14. The recording and reproducing method according to claim **11**,

storing, in the recording medium, instructions that, when executed by the processing circuitry, cause the processing circuitry to execute the face-recognizing process on image information captured from an external camera not included in the recording and reproducing apparatus.

15. The recording and reproducing method according to claim **11**,

in response to the face-recognizing process detecting that a face of a person is included in video information generated by the photographing sensor, displaying, by a display, the video information with a frame surrounding at least a portion of the face of the person.

16. The recording and reproducing method according to claim **15**,

wherein the frame is a rectangular frame.

17. The recording and reproducing method according to claim **11**,

generating, by the processing circuitry, a thumbnail corresponding to the recorded image information such that the thumbnail is displayed on the display with an icon having a predetermined shape when an importance level is set for the recorded image information via a user interface.

18. The recording and reproducing method according to claim **17**,

wherein the icon is displayed on the thumbnail.

19. The recording and reproducing method according to claim **11**,

wherein the predetermined condition is set in accordance with an instruction by a user.

20. The recording and reproducing method according to claim **11**,

wherein the thumbnail images are displayed side by side together with an other thumbnail indicating face region including a third face extracted from a third specific person included in the image information which is different from the first specific person and the second specific person.

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