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Takehara et al.

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(54) **RECORDING APPARATUS, REPRODUCING APPARATUS, RECORDING AND REPRODUCING APPARATUS, RECORDING METHOD, REPRODUCING METHOD, RECORDING AND REPRODUCING METHOD, AND RECORD MEDIUM**

(75) Inventors: **Mitsuru Takehara**, Tokyo (JP); **Yoichiro Sako**, Tokyo (JP); **Toshiro Terauchi**, Tokyo (JP)

(73) Assignee: **Sony Corporation**, Tokyo (JP)

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Primary Examiner — William Thomson
Assistant Examiner — Shirley Jian
(74) *Attorney, Agent, or Firm* — Wolf, Greenfield & Sacks, P.C.

(57) **ABSTRACT**

Changes of a user's emotion that occurs when content is reproduced and a user's surrounding environment that occurs when the content is reproduced are recorded as sensing meta data and content is reproduced in a reproducing mode corresponding to the recorded sensing meta data. Content supplied from a content providing section **11** is normally reproduced. A human body sensor **24** measures biological information of a user of content. An environmental sensor **25** measures a user's surrounding environment. A sensing meta data generating section **19** generates sensing meta data using information detected by at least one of the human body sensor **24** and the environmental sensor **25**. A recording processing section **20** records the generated sensing meta data to a record medium **21**. A reproducing processing section **23** reproduces sensing meta data. A reproducing control section **12** reproduces content in a reproducing mode that changes corresponding to the reproduced sensing meta data.

17 Claims, 6 Drawing Sheets

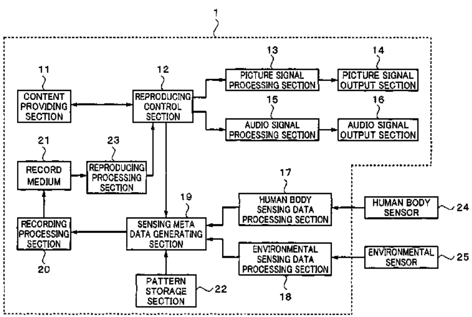

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Fig. 1

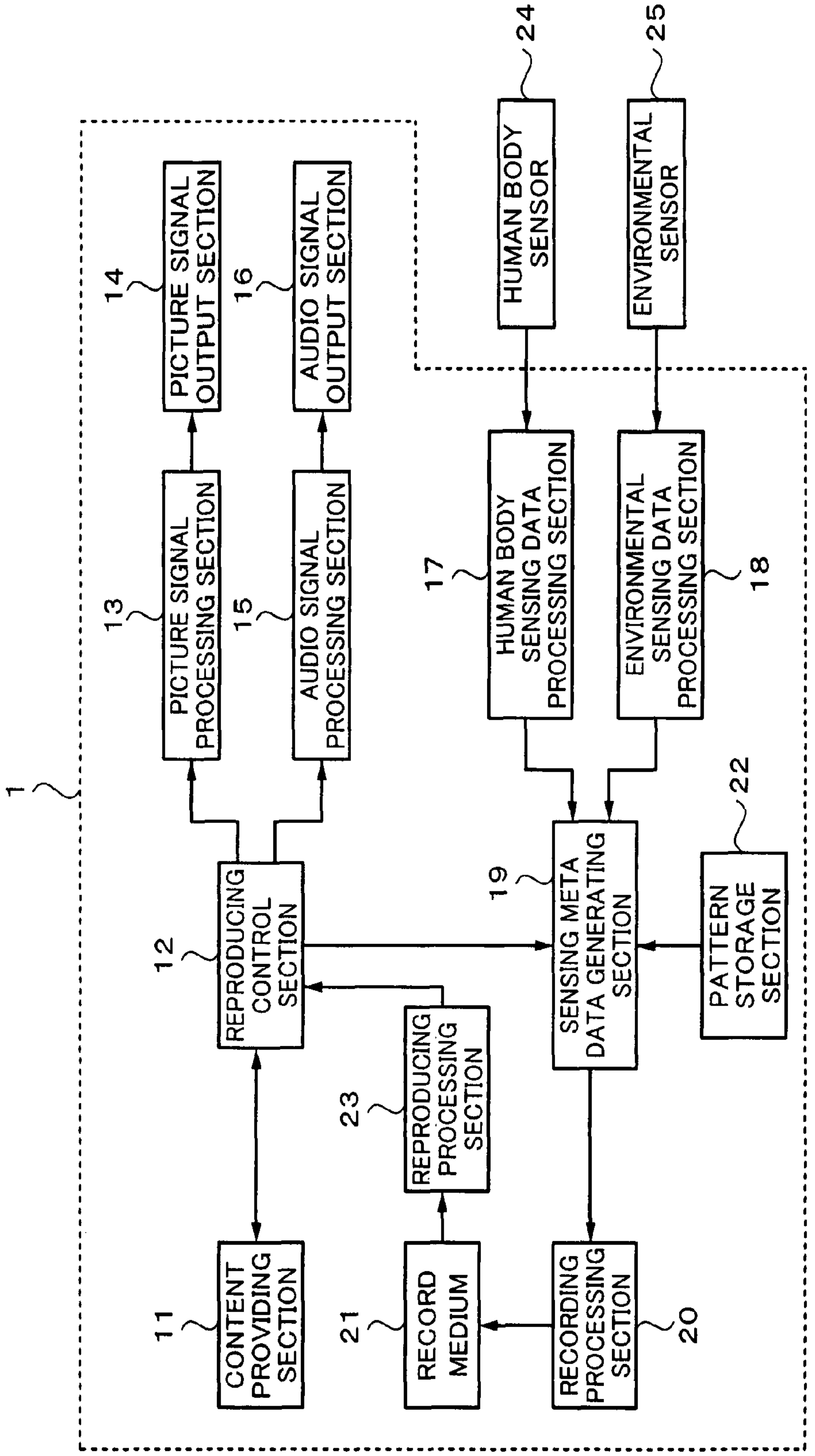

1
11 CONTENT PROVIDING SECTION
12 REPRODUCING CONTROL SECTION
13 PICTURE SIGNAL PROCESSING SECTION
14 PICTURE SIGNAL OUTPUT SECTION
15 AUDIO SIGNAL PROCESSING SECTION
16 AUDIO SIGNAL OUTPUT SECTION
17 HUMAN BODY SENSING DATA PROCESSING SECTION
18 ENVIRONMENTAL SENSING DATA PROCESSING SECTION
19 SENSING META DATA GENERATING SECTION
20 RECORDING PROCESSING SECTION
21 RECORD MEDIUM
22 PATTERN STORAGE SECTION
23 REPRODUCING PROCESSING SECTION
24 HUMAN BODY SENSOR
25 ENVIRONMENTAL SENSOR

Fig. 2

ID OF USER A	
VALUE OF HEART RATE (BEATS/MINUTE)	TIME AT WHICH HEART RATE WAS MEASURED (YEAR, MONTH, DAY, HOUR, MINUTE, SECOND)
72	2006-2-3 20:47:10
75	2006-2-3 20:47:30
71	2006-2-3 20:47:50
⋮	⋮
72	2006-2-3 21:52:10
82	2006-2-3 21:52:30
⋮	⋮

Fig. 3

REPRODUCING POSITION (HOUR, MINUTE, SECOND)	TIME AT WHICH PARTICULAR POSITION WAS REPRODUCED (YEAR, MONTH, DAY, HOUR, MINUTE, SECOND)
00:15:20	2006-2-3 20:47:10
00:15:40	2006-2-3 20:47:30
00:16:00	2006-2-3 20:47:50
⋮	⋮
01:20:20	2006-2-3 21:52:10
01:20:40	2006-2-3 21:52:30
⋮	⋮

Fig. 4

ID OF USER A	
VALUE OF HEART RATE (BEATS/MINUTE)	REPRODUCING POSITION (HOUR, MINUTE, SECOND)
72	00:15:20
75	00:15:40
71	00:16:00
⋮	⋮
72	01:20:20
82	01:20:40
⋮	⋮

Fig. 5

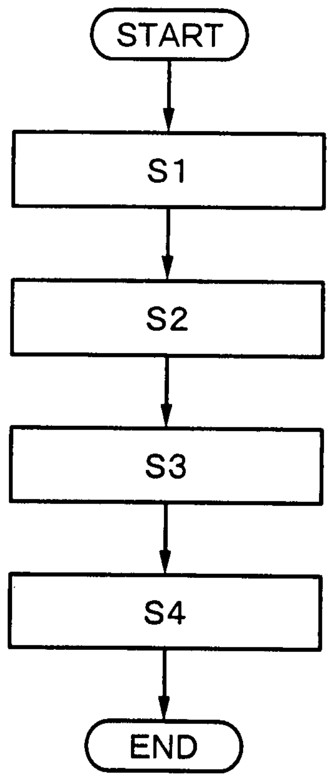
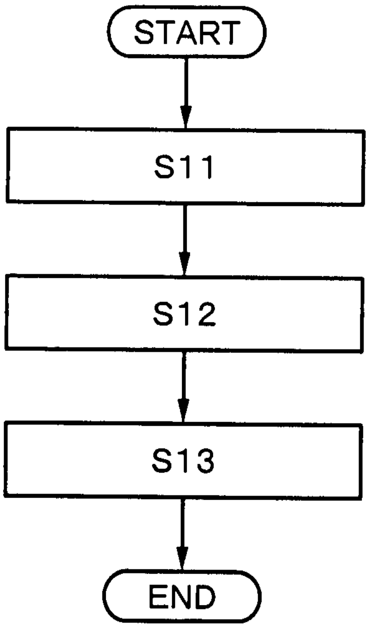


Fig. 6



RECORDING APPARATUS, REPRODUCING APPARATUS, RECORDING AND REPRODUCING APPARATUS, RECORDING METHOD, REPRODUCING METHOD, RECORDING AND REPRODUCING METHOD, AND RECORD MEDIUM

TECHNICAL FIELD

The present invention relates to a recording apparatus and a recording method that record sensing meta data that are sensed when content is reproduced. In addition, the present invention relates to a reproducing apparatus, a recording and reproducing apparatus, a reproducing method, and a recoding and reproducing method that reproduce content corresponding to sensing meta data recorded in a recording medium. Moreover, the present invention relates to a record medium in which sensing meta data have been recorded.

BACKGROUND ART

Additional data referred to as meta data are commonly recorded in record mediums for content such as movies, music, photos, and so forth such that the meta data are associated with the content. When content is a movie, the actors, actresses, director, year of production, plot, and so forth of the movie are recorded as meta data to a record medium. When content is music content, the title, genre, performing duration, performers, and so forth of the music are recorded as meta data to a record medium. These meta data can be reproduced independently from the content. Thus, the viewer/listener of content can easily know a feature of content using meta data.

Content of these movies, music, and so forth is generally narrative and the mental state of the viewer/listener of content changes corresponding to the story development and scenes. In other words, the mental state of the viewer/listener changes, namely he or she is surprised, impressed, disembarrassed, and/or excited corresponding to scenes of content. The changes of the mental state of the viewer/listener are expressed by changes of appearance, presence of perspiration, changes of heart rate, changes of blood pressure, and so forth. The changes of the mental state of the viewer/listener largely depend on the scenes and story development of content and so do the surrounding environment in which he or she is viewing and/or listening to content. For example, if the viewer/listener views a picture of the south pole on a hot midsummer day, he or she tends to feel comfortable. In contrast, if the viewer/listener views the same picture of the south pole on a cold midwinter day, he or she may feel uncomfortable. Thus, the mental state of the viewer/listener variously changes corresponding to scenes of content and the surrounding environment in which he or she is viewing and/or listening to content.

Japanese Patent Application Laid-Open No. 2002-344904 describes a content reproducing apparatus and so forth that measure the reactions of the viewer/listener against content being reproduced and generate evaluation values based on the measured results as well as reproduce content. The content reproducing apparatus and so forth described in Japanese Patent Application Laid-Open No. 2002-344904 change the brightness and sound level of a picture after a predetermined scene on the basis of the evaluated values.

The mental state of the user against content reproduced in the past, his or her surrounding environment, and the use mode of content depend on him or her. An impression of whether the viewer/listener was impressed or excited by a particular scene of content that he or she viewed and/or listened to just depends on him or her. The user may memorize the impression of content in association therewith. If content is reproduced at a user's memorable location, he or she may memorize the location in association with the content.

In the related art, meta data recorded in association with content are information of for example the performers, audiences, plot, and so forth added by the content production side. It is impossible to cause the changes of a user's emotion and his or her surrounding environment that occurred when content was reproduced to recur. In the content reproducing apparatus described in Japanese Patent Application Laid-Open No. 2002-344904, a reproducing mode of content is changed corresponding to a user's reaction against content being reproduced. However, this related art reference does not describe technologies of which changes of a user's emotion and his or her surrounding environment that occurs when content is reproduced are recorded as meta data.

If the mental state of the user and his or her surrounding environment that occurs when content is reproduced can be recorded as meta data in association with content, when the same content is reproduced corresponding to the meta data, the mental sate and surrounding environment of the user that occurred when the content was reproduced can be caused to recur.

DISCLOSURE OF THE INVENTION

Therefore, an object of the present invention is to provide a recording apparatus and a recording method that allow changes of a user's emotion and his or her surrounding environment that occurs when content is reproduced to be recorded as sensing meta data to a record medium.

In addition, another object of the present invention is to provide a reproducing apparatus, a reproducing method, a recording and reproducing apparatus, and a recording and reproducing method that allow content to be reproduced corresponding to sensing meta data that have been recorded.

Moreover, another object of the present invention is to provide a record medium in which changes of a user's emotion and his or her surrounding environment have been recorded as sensing meta data.

The present invention is a recording apparatus, comprising a content providing section which provides content; at least one of a biological information measuring section which measures user's biological information which occurs when the content is reproduced and an environmental measuring section which measures a user's surrounding environment which occurs when the content is reproduced; a sensing meta data generating section which generates sensing meta data using information detected by at least one of the biological information measuring section and the environment measuring section; and a recording processing section which records the generated sensing meta data and the content such that they are associated with each other.

In addition, the present invention is a reproducing apparatus which reproduces provided content, comprising a reproducing processing section which reproduces sensing meta data generated using information detected by at least one of a biological information measuring section which measured user's biological information which occurred when content was reproduced and an environment measuring section which measured a user's surrounding environment which occurred when the content was reproduced from a record medium; and a reproducing controlling section which reproduces the content in a reproducing mode corresponding to the sensing meta data.

In addition the present invention is a recording and reproducing apparatus, comprising a content providing section which provides content; at least one of a biological information measuring section which measures user's biological information that occurs when the content is reproduced and an environmental measuring section which measures a user's surrounding environment which occurs when the content is reproduced; a sensing meta data generating section which generates sensing meta data using information detected by at least one of the biological information measuring section and the environment measuring section; a recording processing section which records the generated sensing meta data in association with the content; a reproducing processing section which reproduces the sensing meta data from the record medium; and a reproducing controlling section which reproduces the content in a reproducing mode corresponding to the sensing meta data.

In addition, the present invention is a recording method, comprising the steps of providing content; generating sensing meta data using information of at least one of user's biological information which occurs when the content is reproduced and user's surrounding environment which occurs when the content is reproduced; and recording the generated sensing meta data and the content such that they are associated with each other.

In addition, the present invention is a reproducing method of reproducing provided content, comprising the steps of reproducing sensing meta data generated using information of at least one of user's biological information measured when content was reproduced and a user's surrounding environment measured when the content was reproduced from a record medium; and reproducing the content in a reproducing mode corresponding to the sensing meta data.

In addition, the present invention is a recording and reproducing method, comprising the steps of providing content; generating sensing meta data using information of at least one of user's biological information which occurs when the content is reproduced and a user's surrounding environment which occurs when the content is reproduced; recording the generated sensing meta data and the content such that they are associated with each other; reproducing the sensing meta data from a record medium; and reproducing the content in a reproducing mode corresponding to the sensing meta data.

In addition, the present invention is a record medium in which sensing meta data generated using information of at least one of user's biological information measured when content was reproduced and a user's surrounding environment measured when the content was reproduced have been recorded such that the sensing meta data are associated with the content.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a block diagram showing a structure of a recording and reproducing apparatus according to an embodiment of the present invention;

FIG. **2** is a schematic diagram showing heart rates measured by a human body sensor according to an embodiment of the present invention;

FIG. **3** is a schematic diagram showing an exemplary relationship between counted times and reproducing positions of content in the recoding and reproducing apparatus according to an embodiment of the present invention;

FIG. **4** is a schematic diagram showing hart rates associated with reproducing positions of content;

FIG. **5** is a flow chart showing a flow of a process of recording sensing meta data according to an embodiment of the present invention; and

FIG. **6** is a flow chart showing a flow of a process of reproducing content corresponding to sensing meta data according to an embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

Next, with reference to the accompanying drawings, an embodiment of the present invention will be described. In this specification, content is at least one of picture information and audio information. Each content is identified by an identifier (hereinafter sometimes referred to as a content ID (Identifier)). Picture information includes all types of visually recognizable information such as pictures, still images (for example photos), graphics, electronics books, text information, and so forth displayed together therewith. Audio information includes all types of acoustically recognizable information such as music, natural sounds, talking voices, and so forth. In addition, a viewer/listener who views and listens to picture content, a listener who listens to audio content, and so forth are generally referred to as the user.

In FIG. **1**, reference numeral **1** represents a main structure of a recording and reproducing apparatus according to an embodiment of the present invention. The recording and reproducing apparatus **1** includes a content providing section **11**, a reproducing control section **12**, a picture signal processing section **13**, a picture signal output section **14**, an audio signal processing section **15**, an audio signal output section **16**, a human body sensing data processing section **17**, an environmental sensing data processing section **18**, a sensing meta data generating section **19**, a recording processing section **20**, a record medium **21**, a pattern storage section **22**, and a reproducing processing section **23**.

The content providing section **11** is a record medium or a storage medium such as an optical disc (for example, a CD-ROM (Compact Disc-Read Only Memory) or a DVD-ROM (Digital Versatile Disc-Read only Memory)), a semiconductor memory, or a magnetic tape. The content providing section **11** is not limited to such a record medium or such a storage medium attachable to and detachable from the recording and reproducing apparatus **1**, but may be a HDD (Hard Disk Drive) built in the recording and reproducing apparatus **1**. The content providing section **11** includes a content distribution server or the like that distributes content through a television broadcast such as a ground analog/digital broadcast or a BS (Broadcasting satellite) digital broadcast or the Internet.

As will be described later, the content providing section **11** supplies content corresponding to a content ID that the user has specified and input to the reproducing control section **12**.

In the normal reproducing mode, the reproducing control section **12** performs a process of reproducing content provided by the content providing section **11**. The reproducing process that the reproducing control section **12** performs depends on a means that provides content. When content has been recoded on an optical disc, the reproducing control section **12** reads a signal with an optical pickup, performs a demodulating process and an error correcting process for the signal that has been read, and temporarily writes the processed signal to a buffer memory. The reproducing control section **12** performs a demultiplexing process for the signal written in the buffer memory and demultiplexes the signal, which has been multiplexed, into a picture signal and an audio signal. The demultiplexed picture signal is supplied to the picture signal processing section **13**, whereas the demultiplexed audio signal is supplied to the audio signal processing section **15**.

When a character signal has been recorded to an optical disc, the character signal demultiplexed by the demultiplexing process is supplied to a character signal processing section (not shown). When necessary, the character signal for which a decoding process and so forth have been performed by the processing section is superimposed with the picture signal and then the resultant signal is provided to the user.

When content is provided through a BS digital broadcast, the reproducing control section **12** performs a carrier wave selecting process for selecting a desired carrier wave from a received radio wave, a demodulating process, an error correcting process, a descrambling process, a demultiplexing process, a packet selecting process, and so forth such that a desired picture PES (Packetized Elementary Stream) and audio PES are extracted. The selected picture PES is supplied to the picture signal processing section **13**, whereas the audio PES is supplied to the audio signal processing section **15**. In such a manner, the reproducing control section **12** performs proper processes corresponding to the content providing section **11**. Processes that the reproducing control section **12** performs may be changed.

Sensing meta data are supplied from the reproducing processing section **23** to the reproducing control section **12**. Besides the normal reproducing mode, the reproducing control section **12** performs a reproducing process for content supplied from the content providing section **11** in a reproducing mode corresponding to the sensing meta data. Details of the sensing meta data will be described later.

The picture signal processing section **13** performs a process of decoding a supplied picture signal and other processes. The picture signal supplied to the picture signal processing section **13** has been compression-encoded according to for example MPEG (Moving Picture Coding Group) 2 system. Thus, the picture signal processing section **13** performs a process of decoding the picture signal that has been compression-encoded. In addition, when necessary, the picture signal processing section **13** performs a D/A (Digital to Analog) converting process of converting the decoded digital picture signal into an analog picture signal. The picture signal that has been converted into an analog signal is supplied to the picture signal output section **14**.

The picture signal output section **14** is a monitor such as a CRT (Cathode Ray Tube), an LCD (Liquid Crystal Display), or an organic EL (Electro Luminescence). The picture signal output section **14** reproduces the picture signal supplied from the picture signal processing section **13**.

The audio signal processing section **15** performs a process of decoding the supplied audio signal and other processes. The audio signal supplied to the audio signal processing section **15** has been compression-encoded according to for example MP3 (MPEG1-Audio Layer-III) system or MPEG2 AAC (Advanced Audio Coding) system. Thus, the audio signal processing section **15** performs a process of decoding the audio signal that has been compression-encoded. When necessary, the audio signal processing section **15** performs a D/A (Digital to Audio) converting process of converting the decoded digital audio signal into an analog signal. The audio signal that has been converted into an analog signal is supplied to the audio signal output section **16**.

The audio signal output section **16** is for example a speaker or a headphone. The audio signal output section **16** reproduces the audio signal supplied from the audio signal processing section **15**.

The picture signal processing section **13** and the audio signal processing section **15** decode the picture signal and the audio signal on the basis of timing information such as a DTS (Decoding Time Stamp) that has been recorded on an optical disc along with content or that has been multiplexed as a PES with a broadcast wave. In addition, since the picture signal and the audio signal are synchronized with timing information such as a PTS (Presentation Time Stamp) that has been recoded on an optical disc along with content or that has been multiplexed as a PES with a broadcast wave, the picture and sound are synchronously provided to the user.

At least one of the picture signal output section **14** and the audio signal output section **16** may be separated from the recording and reproducing apparatus **1**. For example, the picture signal may be wirelessly transmitted to the picture signal output section **14** disposed independently from the recording and reproducing apparatus **1** and the picture signal may be reproduced from the picture signal output section **14**.

The human body sensing data processing section **17** converts information (hereinafter, the information is sometimes referred to as human body sensing data) detected by a human body sensor **24** (that will be described later) into an electric signal and records the converted human body sensing data. In this embodiment, the human body sensing data are biological information such as electrocardiogram, breathing rate, breathing cycle, electromyogram, cerebral blood flow, brain wave, amount of perspiration, cutaneous temperature, pupil diameter, eye opening degree, limb temperature, body surface temperature, changes of appearance, and changes of blinking. Each data record of the human body sensing data is identified by the user ID of each user. The human body sensing data recorded by the human body sensing data processing section **17** are supplied to the sensing meta data generating section **19**.

The environmental sensing data processing section **18** converts information (hereinafter this information sometimes referred to as environmental sensing data) detected by an environmental sensor **25** (that will be described later) into an electric signal and records the converted environmental sensing data. In this case, the environmental sensing data are at least one of temperature, humidity, airflow volume, atmospheric pressure, weather, location, and so forth. Each data record of the environmental sensing data is identified by the user ID of each user. The environmental sensing data recorded by the environmental sensing data processing section **18** are supplied to the sensing meta data generating section **19**.

The sensing meta data generating section **19** generates sensing meta data using at least one of the human body sensing data and the environmental sensing data that have been supplied. The sensing meta data generating section **19** generates sensing meta data that represent the user's emotion or changes of the user's emotion that occurs when content is reproduced using for example the supplied human body sensing data. In addition, the sensing meta data generating section **19** generates sensing meta data that represent a user's surrounding environment that occurs when content is reproduced using the supplied environmental sensing meta data.

Specifically, the sensing meta data generating section **19** collates for example changes of the heart rate and changes of the appearance such as movement of the lips, blinking of eyes, and so forth obtained from the human body sensing data with data stored in the pattern storage section **22** and determines the user's emotion (joy, sadness, surprise, anger, and so forth) in a particular region of content. The sensing meta data generating section **19** generates sensing meta data that represent changes of the user's emotion in for example an XML (eXtensible Markup Language) format. In this embodiment, the pattern storage section **22** is preferably composed of a non-volatile memory such as a HDD and stores emotional patterns corresponding to changes of human body sensing data. The pattern storage section **22** stores for example changes of heart rate, changes of amount of perspiration, changes of body surface temperature, and so forth of the user and patterns of the emotion such as excitement, stress, calmness, and so forth corresponding to these changes.

In addition, the sensing meta data generating section **19** can collate for example the amount of perspiration, increase rate of heart rate, and changes of diameter of pupil obtained from the human body sending data with data stored in the pattern storage section **22** and determine the user's emotion such as surprise, stress, and so forth. The sensing meta data generating section **19** generates sensing meta data that represent the determined user's emotion.

In addition, the sensing meta data generating section **19** generates sensing meta data that represent the user's surrounding environment that occurs when content is reproduced using the environmental sensing data. The sensing meta data generating section **19** generates sensing meta data that describe for example temperature, humidity, airflow amount, atmospheric pressure, and weather (fine, cloudiness, rain, snow, storm, and so forth) in the XML format. With respect to the location at which the user stays when content is reproduced, the sensing meta data generating section **19** generates information of for example latitude and longitude.

A content ID that identifies content that the reproducing control section **12** normally reproduces is supplied to the sensing meta data generating section **19**. As a content ID, for example the title of content is used. The sensing meta data generating section **19** supplies the sensing meta data, user ID, and content ID to the recording processing section **20**.

The recording processing section **20** performs processes of converting the supplied sensing meta data, user ID, and content ID into those in a format suitable for the record medium **21**, correlating the converted sensing meta data and so forth with content, and recording the resultant data to the record medium **21**. The recording processing section **20** performs a recording process corresponding to the record medium **21**. The record medium **21** is a recordable optical disc or a rewritable optical disc, for example, a CD-R (Recordable), a CD-RW (Rewritable), a DVD-R, or a DVD-RW, or a magnetic tape. Instead, the record medium **21** may be a storage medium such as a semiconductor memory or a HDD built in the recording and reproducing apparatus **1**.

The reproducing processing section **23** performs a process of reproducing sensing meta data recorded in the record medium **21**. The reproducing processing section **23** performs a process of reproducing sensing meta data from the record medium **21** corresponding to the user ID and content ID that the user has specified and input. The reproducing processing section **23** performs a reproducing process suitable for the record medium **21**. When the reproducing processing section **23** performs the reproducing process, the reproducing processing section **23** reproduces sensing meta data from the record medium **21** and supplies the reproduced sensing meta data to the reproducing control section **12**.

Next, the human body sensor **24** and the environmental sensor **25** will be described. The human body sensor **24** that is an example of the biological information measurement section is a device that is worn on the body of the user of content and that measures various types of human body sensing data. Of course, the human body sensor **24** may have additional functions such as a clock function as well as the function of measuring human body sensing data. In this embodiment, the human body sensor **24** can wirelessly communicate with the recording and reproducing apparatus **1** and transmit the measured human body sensing data to the recording and reproducing apparatus **1**.

The human body sensor **24** is not limited to a device worn on the body of the user of content. Examples of the human body sensor **24** include an imaging device that is disposed in the recording and reproducing apparatus **1** and that photographs the appearance of the user and an infrared thermography that measures the body surface temperature of the user.

The environmental sensor **25** that is an example of the environment measuring section is composed of a thermometer, a humidity meter, an airflow volume meter, a barometer, an imaging device (that determines the weather), and so forth. The environmental sensor **25** may be worn on the body of the user or attached to the recording and reproducing apparatus **1**. The environmental sensor **25** also includes a GPS (Global Positioning System) reception terminal or the like that detects environmental sensing data that represent a location. Thus, the environmental sensor **25** can identify the location at which the user is viewing and/or listening to content with the GPS. Instead, a location registration signal that is communicated between a user's mobile phone and a base station may be received such that the location at which content is being reproduced is identified.

Next, a specific example of which sensing meta data generated by the sensing meta data generating section **19** are recorded to the record medium **21** will be described. In the following specific example, content is picture content that is supplied from the content providing section **11** and whose information changes on the time axis. The human body sensor **24** is a wristwatch type heart rate meter that has both a wristwatch function and a heart rate meter function. The human body sensor **24** measures for example the heart rate of the user as human body sending meta data. In this embodiment, the heart rate means the number of beats per minute (BPM). The heat rate measured by the human body sensor **24** is wirelessly transmitted to the recording and reproducing apparatus **1** along with the user ID that represents the user of the human body sensor **24**.

In addition, it is assumed that times counted by the recording and reproducing apparatus **1** match times counted by the human body sensor **24**. When the recording and reproducing apparatus **1** and the human body sensor **24** receive a radio wave that represents the standard time, times counted by the recording and reproducing apparatus **1** can be matched with times counted by the human body sensor **24**. Instead, when the standard time is obtained through the Internet, times counted by the recording and reproducing apparatus **1** can be matched with times counted by the human body sensor **24**.

The content providing section **11** supplies picture content. The reproducing control section **12** performs a normal reproducing process for the supplied content. The picture signal processing section **13** and the audio signal processing section **15** perform a decoding process and so forth. The picture signal output section **14** reproduces a picture. The audio signal output section **16** reproduces a sound. While the picture signal output section **14** and the audio signal output section **16** reproduce content, the human body sensor **24** measures the heart rate.

FIG. **2** shows exemplary heart rates of user A measured by the human body sensor **24**. The human body sensor **24** samples the heart rates at intervals of a predetermined time period or a predetermined cycle. In addition, the human body sensor **24** counts times at which the heart rates are measured. In this example, as shown in FIG. **2**, heart rate "72" was measured at time "2006-2-3 20:47:10 (in the order of year, month, day, hour, minute, second)". Other heart rates were measured in association with information of times.

The human body sensor **24** transmits the user ID that identifies user A, the heart rate of user A measured when content is reproduced in the normal reproducing mode, and information of times at which the heart rates are measured (hereinafter these information is sometimes referred to as the user ID and so forth) to the recording and reproducing apparatus **1**. As the user ID, the serial number assigned to the human body sensor **24** or a number that user A has input may be used. The recording and reproducing apparatus **1** receives the user ID and so forth and supplies them to the human body sensing data processing section **17**. The human body sensing data processing section **17** converts the user ID and so forth transmitted from the human body sensor **24** into an electric signal and records the converted user ID and so forth. The recorded user ID and so forth are supplied to the sensing meta data generating section **19**.

On the other hand, the recording and reproducing apparatus **1** can count the present time with its built-in clock circuit or the like. In addition, the reproducing control section **12** can obtain information of reproducing positions of picture content that the recording and reproducing apparatus **1** is reproducing in the normal reproducing mode. FIG. **3** shows exemplary reproducing positions of picture content corresponding to information of times that the recording and reproducing apparatus **1** is counting. For example, time "2006-2-3 20:47:10" counted by the recording and reproducing apparatus **1** corresponds to reproducing position "00:15:20" of picture content.

The sensing meta data generating section **19** determines information of times at which heart rates were measured and the reproducing positions corresponding to the information of times and associates the reproducing positions of the picture content with the measured heart rates. As described with reference to FIG. **2** and FIG. **3**, the human body sensor **24** measured for example heart rate "72" and reproducing position "00:15:20" at time "2006-2-3 20:47:10". Thus, as shown in FIG. **4**, reproducing position "00:15:20" of the picture content is associated with heart rate "72". Likewise, other measured heart rates are associated with reproducing positions of the picture content.

The sensing meta data generating section **19** references past patterns stored in the pattern storage section **22** and extracts a user's emotion corresponding to changes of the heart rate from the pattern storage section **22**. For example, the sensing meta data generating section **19** searches past patterns stored in the pattern storage section **22** for a pattern similar to the user's emotion. The sensing meta data generating section **19** extracts an emotion corresponding to the retrieved pattern as a user's emotion that occurs when content is reproduced.

For example, in a region from reproducing position "00:15:20" to reproducing position "00:15:40" of picture content corresponding to changes of heart rate "72" to heart rate "75", since the heart rate slightly increased, it is thought that the user was excited when picture content was reproduced. In a region from reproducing position "00:15:40" to reproducing position "00:16:00" of picture content corresponding to changes of heart rate "75" to heart rate "71", since the heart rate decreased, it is thought that the user was calm when picture content was reproduced. At reproducing position "01:20:40" of picture content, since the heart rate was as high as 82, it is thought that the user was surprised.

Thereafter, the sensing meta data generating section **19** generates sensing meta data that represent the reproducing positions of picture content, the reproducing regions of picture content, and corresponding user's emotions. The sensing meta data generated by the sensing meta data generating section **19** are supplied to the recording processing section **20**. In addition, the sensing meta data generating section **19** supplies the user ID that identifies user A who is a user of content reproduced in the normal reproducing mode and the content ID that identifies picture content reproduced in the normal reproducing mode to the recording processing section **20**.

The recording processing section **20** converts the supplied sensing meta data, user ID, and content ID into those in a format suitable for the record medium **21**. The resultant sensing meta data, user ID, and content ID that have been converted in the format suitable for the record medium **21** by the recording process of the recording processing section **20** are recorded to the record medium **21**.

In the foregoing, a specific example of which sensing meta data are generated using human body sensing data such as a heart rate was described. Instead, sensing meta data may be generated using environmental sensing data. When sensing meta data are generated using environmental sensing data that represent for example temperature, humidity, airflow volume, weather, and/or location are used, it is not necessary to measure these data in the chronological order.

In addition, content such as photos whose information does not change on the time axis and meta data generated from environmental sensing data may be recorded to the record medium **21**. In the process of recording sensing meta data, information of times may not be essential.

FIG. **5** is a flow chart showing a flow of a process of recording sensing meta data according to an embodiment of the present invention. In the process described with reference to FIG. **5**, it is assumed that content is audio content.

At step S**1**, a process of reproducing content is performed. In other words, the reproducing processing section **12** performs a normal reproducing process for audio content supplied from the content providing section **11**. The audio signal processing section **15** performs a decoding process and other processes for audio content that has been reproduced. The audio signal output section **16** reproduces audio content for the user. After the content reproducing process has been completed, the flow advances to step S**2**.

At step S**2**, the sensing process is started. In other words, at least one of user's human body sensing data that occur when content is reproduced and environmental sensing data that occur when content is reproduced are measured using at least one of the human body sensor **24** and the environmental sensor **25**. The measured human body sensing data are supplied to the human body sensing data processing section **17**. The measured environmental sensing data are supplied to the environmental sensing data processing section **18**. At least one of the human body sensing data and environmental sensing data that have been processed by the human body sensing data processing section **17** and the environmental sensing data processing section **18** is supplied to the sensing meta data generating section **19**.

It is preferred that the sensing process at step S**2** be started when the reproduction of content is started. Instead, the sensing process may be started while content is being reproduced. After the sensing process has been started, the flow advances to step S**3**.

At step S**3**, the sensing meta data generating section **19** performs a process of generating sensing meta data. The sensing meta data generating section **19** generates sensing meta data using at least one of human body sensing data supplied from the human body sensing data processing section **17** and environmental sensing meta data supplied from the environmental sensing data processing section **18**. When the sensing meta data have been generated, the flow advances to step S**4**.

At step S**4**, a process of recording the generated sensing meta data is performed. The sensing meta data generated at step S**3** are supplied to the recording processing section **20**. In addition, a user ID that identifies the user of content that is normally reproduced and a content ID that identifies content that is normally reproduced are supplied to the recording processing section **20**. The recording processing section **20** converts the sensing meta data, user ID, and content ID into those in a format suitable for the record medium **21**. The converted sensing meta data, user ID, and content ID are recorded to the record medium **21**.

Next, a process of reproducing sensing meta data and so forth from the record medium **21** will be described. FIG. **6** is a flow chart showing a flow of a reproducing process according to an embodiment of the present invention.

At step S**11**, a process of obtaining sensing meta data is performed. For example, the user inputs a user ID and a content ID. The user ID and content ID that have been input are specified for the reproducing processing section **23**. The reproducing processing section **23** reproduces sensing meta data corresponding to the specified user ID and content ID from the record medium **21**. The reproduced sensing meta data are supplied to the reproducing control section **12**. Thereafter, the flow advances to step S**12**.

At step S**12**, a process of obtaining content is performed. The content ID that the user has input is specified for the content providing section **11**. The content providing section **11** supplies content corresponding to the specified content ID to the reproducing control section **12**. For example, the content providing section **11** accesses a content distribution server and downloads content identified by the content ID therefrom. The downloaded content is supplied to the reproducing control section **12**. If the content providing section **11** is not able to provide content identified by the content ID, for example the picture signal output section **14** displays an error message or the audio signal output section **16** generates an alarm sound. Thereafter, the flow advances to step S**13**.

At step S**13**, a process of reproducing content is performed. At step S**13**, the reproducing control section **12** performs a process of reproducing content in other than the normal reproducing mode. Namely, the reproduction control section **12** performs a process of reproducing content supplied from the content providing section **11** in a reproducing mode corresponding to sensing meta data supplied from the reproducing control section **12**. Next, an example of a process of reproducing content in a reproducing mode corresponding to sensing meta data will be described.

When content is picture content, the reproducing control section **12** changes its luminance level, contrast, and/or hue corresponding to a user's emotion at a reproducing position or in a reproducing region of the picture content described in the sensing meta data. When content is audio content, the reproducing control section **12** changes its frequency characteristic and/or sound volume level and/or creates a sound effect for the audio content corresponding to a user's emotion in a particular region of the audio content described in the sensing meta data. A scene corresponding to a reproducing position of content determined to have been excited may be reproduced as a digest reproducing mode. Thus, content can be reproduced such that a scene with which a user's emotion changed is emphasized.

Picture content that has been processed by the reproducing control section **12** is supplied to the picture signal processing section **13**. Audio content that has been processed by the reproducing control section **12** is supplied to the audio signal processing section **15**. The picture signal processing section **13** and the audio signal processing section **15** perform a decoding process and so forth. Picture content and audio content are reproduced from the picture signal output section **14** and the audio signal output section **16**, respectively, in a reproducing mode corresponding to the sensing meta data.

When sensing meta data are composed of environmental sensing meta data, the reproducing control section **12** reproduces content such that the user can recognize a surrounding environment specified by the sensing meta data.

When content is picture content, the reproducing control section **12** superimposes picture content with data that represent temperature, humidity, location, and so forth obtained from the sensing meta data. The picture signal processing section **13** performs a decoding process and so forth for the picture content superimposed with such data. The picture content for which the decoding process and so forth have been performed is output to the picture signal output section **14**. At this point, the picture signal output section **14** reproduces together with the picture content the character information that represents temperature, humidity, location, and so forth that occurred when the same picture content was reproduced. Thus, the user can recognize the surrounding environment that occurred when the picture content was reproduced in the past.

When content is audio content, the reproducing control section **12** performs for example the following processes. When sensing meta data specify that the weather that occurred when audio content was reproduced in the past was rain and strong wind, the reproducing control section **12** superimposes audio content with data of sounds of rain and wind. The reproduction control section **12** supplies the audio content superimposed with data of sounds of rain and wind to the audio signal processing section **15**. The audio signal processing section **15** performs a decoding process and so forth for the audio content. The audio content that has been processed is reproduced from the audio signal output section **16**. At this point, when the user hears sounds of rain and wind together with the audio content, he or she can recognize his or her surrounding environment that occurred when the audio content was reproduced in the past. When the user recognizes his or her surrounding environment that occurred when the audio content was reproduced in the past, he or she can remember a memory in association with the audio content.

Instead, the reproducing control section **12** may control the content providing section **11** to download data of sounds of rain and wind through a network. The downloaded data of sounds of rain and wind are supplied from the content providing section **11** to the reproducing control section **12**. The reproducing control section **12** superimposes audio content with data of sounds of rain and wind.

When sensing meta data that represent a location at which the user stayed when audio content was reproduced in the past have been recorded in the record medium **21**, the audio content may be reproduced in the following manner. The reproducing control section **12** and the audio signal processing section **15** perform predetermined processes for audio content provided from the content providing section **11** or the record medium **21**. The audio signal output section **16** reproduces the resultant audio content.

Sensing meta data that represent a location at which the user stayed when audio content was reproduced in the past are obtained by the reproducing process of the reproducing processing section **23**. The obtained sensing data are supplied to the reproducing control section **12**. The reproducing control section **12** controls the content providing section **11** to obtain data of photos of surrounding scenes for example mountains, rivers, forests, seashores, and so forth of the location at which the user stayed when audio content was reproduced in the past corresponding to the sensing meta data. For example, the reproducing control section **12** accesses a server that distributes photos to obtain data of photos of various scenes therefrom. Data of photos that have been obtained are supplied from the content providing section **11** to the reproducing control section **12**.

Data of photos are supplied from the reproducing control section **12** to the picture signal processing section **13**. The picture signal processing section **13** performs a decoding process and so forth. Data of photos that have been processed are supplied to the picture signal output section **14**. The picture signal output section **14** reproduces scenes such as mountains, rivers, forests, seashores, and so forth. While the user is viewing scenes reproduced by the picture signal output section **14**, he or she listens to audio content. Thus, the user can recognize surrounding scenes that occurred when audio content was reproduced in the past. As a result, the user can remember a memory in association with the audio content.

When content is reproduced in a reproducing mode corresponding to sensing meta data, the user can recognize changes of his or her emotion that occurred when the content was reproduced in the past. In addition, a user's surrounding environment that occurred when content was reproduced in the past can be caused to recur. Thus, the user can remember a memory in association with the content.

The processes described with reference to FIG. **5** and FIG. **6** may be structured as a recording and reproducing method of recording sensing meta data and reproducing content in a reproducing mode corresponding to the recorded sensing meta data.

Although embodiments of the present invention were specifically described, the present invention is not limited to the foregoing embodiments. Instead, various types of modifications based on the spirit of the art of the present invention may be made.

In the foregoing embodiments, the present invention was described as a recoding and reproducing apparatus. Instead, the present invention may be applied to a recording apparatus that records sensing meta data generated when content is normally reproduced. Instead, the present invention may be applied to a reproducing apparatus that reproduces content in a reproducing mode corresponding to sensing meta data recorded to a record medium.

Although a process of normally reproducing content and a process of reproducing content in a reproducing mode corresponding to sensing meta data are performed in the reproducing control section **12**, they may be selected by the user.

When the content providing section **11** is a recordable or rewritable optical disc or a semiconductor memory, generated sensing meta data may be recorded to the content providing section **11**.

Each means that composes an apparatus of the present invention may be structured by a dedicated hardware circuit, software, or a programmed computer. A program that describes a sequence of steps of a process may be recorded to a record medium such as a magnetic recoding device, an optical disc, an optical-magnetic disc, a semiconductor memory, or the like from which a computer can read the program.

As described above, according to the present invention, changes of a user's emotion that occur when content is reproduced and surrounding environment that occurs when content is reproduced can be recorded as sensing meta data to a record medium such as an optical disc or a semiconductor memory. When content is reproduced corresponding to sensing meta data that have been recorded, changes of a user's emotion that occurred when content was reproduced in the past and a user's surrounding environment that occurred when the content was reproduced in the past can be caused to recur. When changes of a user's emotion and a user's surrounding environment are caused to recur, he or she can remember a memory in association with content.

The invention claimed is:

1. A recording and reproducing apparatus comprising:

a content providing section that provides entertainment content comprising a movie, music, and/or a photo;

a biological information measuring section that measures at least one user's biological information while the entertainment content is reproduced;

an environment measuring section that measures at least one environmental characteristic of the at least one user's surrounding environment while the entertainment content is reproduced, the at least one environmental characteristic being selected from the group consisting of temperature, humidity, airflow volume, atmospheric pressure, weather, and location;

a sensing metadata generating section that generates sensing metadata using information detected by the biological information measuring section and the environment measuring section;

a recording processing section that records in at least one storage medium the sensing metadata and the entertainment content such that the sensing metadata are associated with the entertainment content, and such that the at least one measured environmental characteristic is associated with the entertainment content that was being reproduced when the at least one environmental characteristic was measured; and

a reproducing controlling section that reproduces the entertainment content a second time different from the first time, in an enhanced reproducing mode adapted, based on the sensing metadata, to reinforce the at least one user's memory of changes of the at least one user's emotion that occurred while the entertainment content was reproduced the first time and/or the at least one user's surrounding environment that was measured while the entertainment content was reproduced the first time, wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises adjusting one or more features within the entertainment content to cause the memory to recur.

2. The recording and reproducing apparatus of claim **1**, wherein the entertainment content comprises picture content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a luminance level, contrast, and/or hue of the picture content corresponding to the at least one user's emotion at a reproducing position and/or in a reproducing region of the picture content described in the sensing metadata.

3. The recording and reproducing apparatus of claim **1**, wherein the entertainment content comprises audio content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a frequency characteristic and/or a sound volume level and/or creating a sound effect for the audio content corresponding to the at least one user's emotion in a particular region of the audio content described in the sensing metadata.

4. A reproducing apparatus that reproduces entertainment content comprising a movie, music, and/or a photo, the reproducing apparatus comprising:

a reproducing processing section that reproduces sensing metadata from at least one storage medium, wherein the sensing metadata was generated using biological information measured from at least one user while the entertainment content was reproduced a first time and/or environmental information measured from the at least one user's surrounding environment while the entertainment content was reproduced the first time; and

a reproducing controlling section that reproduces the entertainment content a second time different from the first time, in an enhanced reproducing mode adapted, based on the sensing metadata, to reinforce the at least one user's memory of changes of the at least one user's emotion that occurred while the entertainment content was reproduced the first time and/or the at least one user's surrounding environment that was measured while the entertainment content was reproduced the first time, wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises adjusting one or more features within the entertainment content to cause the memory to recur.

5. The reproducing apparatus as set forth in claim **4**, wherein the reproducing controlling section reproduces the entertainment content such that the at least one user of the entertainment content is capable of recognizing the at least one user's surrounding environment specified by the sensing metadata.

6. A recording and reproducing apparatus, comprising:

a content providing section that provides entertainment content comprising a movie, music, and/or a photo;

a biological information measuring section that measures at least one user's biological information while the entertainment content is reproduced a first time and/or an environment measuring section that measures the at least one user's surrounding environment while the entertainment content is reproduced the first time;

a sensing metadata generating section that generates sensing metadata using information detected by the biological information measuring section and/or the environment measuring section;

a recording processing section that records in at least one storage medium the sensing metadata in association with the entertainment content; and

a reproducing controlling section that reproduces the entertainment content a second time different from the first time, in an enhanced reproducing mode adapted, based on the sensing metadata, to reinforce the at least one user's memory of changes of the at least one user's emotion that occurred while the entertainment content was reproduced the first time and/or the at least one user's surrounding environment that was measured while the entertainment content was reproduced the first time, wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises adjusting one or more features within the entertainment content to cause the memory to recur.

7. The recording and reproducing apparatus as set forth in claim **6**, wherein the reproducing controlling section reproduces the entertainment content such that the at least one user of the entertainment content is capable of recognizing the at least one user's surrounding environment specified by the sensing metadata.

8. The recording and reproducing apparatus of claim **6**, wherein the entertainment content comprises picture content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a luminance level, contrast, and/or hue of the picture content corresponding to the at least one user's emotion at a reproducing position and/or in a reproducing region of the picture content described in the sensing metadata.

9. The recording and reproducing apparatus of claim **6**, wherein the entertainment content comprises audio content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a frequency characteristic and/or a sound volume level and/or creating a sound effect for the audio content corresponding to the at least one user's emotion in a particular region of the audio content described in the sensing metadata.

10. A recording and reproducing method, comprising:

generating, using at least one computer, sensing metadata using at least one user's biological information measured while entertainment content comprising a movie, music, and/or a photo is reproduced and environmental information measured from the at least one user's surrounding environment while the entertainment content is reproduced, the environmental information comprising at least one measurement of at least one characteristic selected from the group consisting of temperature, humidity, airflow volume, atmospheric pressure, weather, and location;

recording in at least one storage medium the sensing metadata and the entertainment content such that the sensing metadata are associated with the entertainment content, and such that the environmental information is associated with the entertainment content that was being reproduced when the environmental information was measured; and

reproducing the entertainment content a second time different from the first time, in an enhanced reproducing mode adapted, based on the sensing metadata, to reinforce the at least one user's memory of changes of the at least one user's emotion that occurred while the entertainment content was reproduced the first time and/or the at least one user's surrounding environment that was measured while the entertainment content was reproduced the first time, wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises adjusting one or more features within the entertainment content to cause the memory to recur.

11. The recording and reproducing method of claim **10**, wherein the entertainment content comprises picture content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a luminance level, contrast, and/or hue of the picture content corresponding to the at least one user's emotion at a reproducing position and/or in a reproducing region of the picture content described in the sensing metadata.

12. The recording and reproducing method of claim **10**, wherein the entertainment content comprises audio content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a frequency characteristic and/or a sound volume level and/or creating a sound effect for the audio content corresponding to the at least one user's emotion in a particular region of the audio content described in the sensing metadata.

13. A reproducing method of reproducing entertainment content comprising a movie, music, and/or a photo, the reproducing method comprising:

reproducing from a storage medium sensing metadata generated using biological information measured from at least one user while the entertainment content was reproduced a first time and/or environmental information measured from the at least one user's surrounding environment while the entertainment content was reproduced the first time; and

reproducing the entertainment content a second time different from the first time, in an enhanced reproducing mode adapted, based on the sensing metadata, to reinforce the at least one user's memory of changes of the at least one user's emotion that occurred while the entertainment content was reproduced the first time and/or the at least one user's surrounding environment that was measured while the entertainment content was reproduced the first time, wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises adjusting one or more features within the entertainment content to cause the memory to recur.

14. A recording and reproducing method, comprising:

generating sensing metadata using biological information measured from at least one user while entertainment content comprising a movie, music, and/or a photo is reproduced a first time and/or environmental information measured from the at least one user's surrounding environment while the entertainment content is reproduced the first time;

recording in at least one storage medium the sensing meta data and the entertainment content such that the sensing metadata are associated with the entertainment content; and

reproducing the entertainment content a second time different from the first time, in an enhanced reproducing mode adapted, based on the sensing metadata, to reinforce the at least one user's memory of changes of the at least one user's emotion that occurred while the entertainment content was reproduced the first time and/or the at least one user's surrounding environment that was measured while the entertainment content was reproduced the first time, wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises adjusting one or more features within the entertainment content to cause the memory to recur.

15. The recording and reproducing method of claim **14**, wherein the entertainment content comprises picture content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a luminance level, contrast, and/or hue of the picture content corresponding to the at least one user's emotion at a reproducing position and/or in a reproducing region of the picture content described in the sensing metadata.

16. The recording and reproducing method of claim **14**, wherein the entertainment content comprises audio content, and wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises changing a frequency characteristic and/or a sound volume level and/or creating a sound effect for the audio content corresponding to the at least one user's emotion in a particular region of the audio content described in the sensing metadata.

17. At least one computer-readable storage medium storing program instructions for causing a computer to:

reproduce sensing metadata generated using at least one user's biological information measured while entertainment content comprising a movie, music, and/or a photo was reproduced a first time and environmental information measured from the at least one user's surrounding environment while the entertainment content was reproduced the first time; and

reproduce the entertainment content a second time different from the first time, in an enhanced reproducing mode adapted, based on the sensing metadata, to reinforce the at least one user's memory of changes of the at least one user's emotion that occurred while the entertainment content was reproduced the first time and/or the at least one user's surrounding environment that was measured while the entertainment content was reproduced the first time, wherein reproducing the entertainment content the second time in the enhanced reproducing mode comprises adjusting one or more features within the entertainment content to cause the memory to recur.

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专利名称(译)	记录设备，再现设备，记录和再现设备，记录方法，再现方法，记录和再现方法，以及记录介质		
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摘要(译)

再现内容时发生的用户情绪的变化和再现内容时发生的用户周围环境被记录为感测元数据，并且内容以与记录的感测元数据相对应的再现模式被再现。通常再现从内容提供部分 11 提供的内容。人体传感器 24 测量内容用户的生物信息。环境传感器 25 测量用户的周围环境。感测元数据生成部分 19 使用由人体传感器 24 和环境传感器 25 中的至少一个检测到的信息生成感测元数据。 。记录处理部分 20 将所生成的感测元数据记录到记录介质 21 。再现处理部分 23 再现感测元数据。再现控制部分 12 以再现模式再现内容，该再现模式对应于再现的感测元数据而改变。