[0004]

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Summary of Invention

Technical Problem

[0005]

However, the conventional method is limited to a case in which a device to which the method is applied has three color light sources such as an illuminator. ~~The~~Embodiments of the present invention ~~solves this problem, and~~ provide~~s~~ an information communication method that enable~~s~~ communication between various devices including a device with low computational performance.

Solution to Problem

[0006]

~~An information communication method according to an aspect of the present invention is an information communication method of obtaining information from a subject, the information communication method including: transmitting position information indicating a position of an image sensor used to capture the subject; receiving an ID list that is associated with the position indicated by the position information and includes a plurality of sets of identification information; setting an exposure time of the image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject; obtaining a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time; obtaining the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image; and searching the ID list for identification information that includes the obtained information.~~

According to a first aspect of the present invention, there is provided an information communication method of obtaining

information from a subject, the information communication method comprising: setting an exposure time of an image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject; obtaining a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time; and obtaining the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image, wherein in the obtaining of a bright line image, the bright line image including a plurality of parts where the bright line appears is obtained by capturing a plurality of the subjects, in the obtaining of the information, a position of each of the plurality of subjects is obtained by demodulating, for each of the plurality of parts, the data specified by the pattern of the bright line in the part, and the information communication method further comprises estimating a position of the image sensor, based on the obtained position of each of the plurality of subjects.

[0006a]

According to a second aspect of the present invention, there is provided an information communication device that obtains information from a subject, the information communication device comprising: an exposure time setting unit configured to set an exposure time of an image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject; an image obtainment unit including the image sensor and configured to obtain a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time; and an information obtainment unit configured to obtain the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image, wherein the image obtainment unit is configured to obtain the bright line image including a plurality of parts where the bright line appears by

capturing a plurality of the subjects, the information obtainment unit is configured to obtain a position of each of the plurality of subjects by demodulating, for each of the plurality of parts, the data specified by the pattern of the bright line in the part, and the information communication device further comprises a position estimation unit configured to estimate a position of the image sensor, based on the obtained position of each of the plurality of subjects.

[0006b]

According to a third aspect of the present invention, there is provided a program for obtaining information from a subject, the program causing a computer to execute: setting an exposure time of an image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject; obtaining a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time; and obtaining the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image, wherein in the obtaining of a bright line image, the bright line image including a plurality of parts where the bright line appears is obtained by capturing a plurality of the subjects, in the obtaining of the information, a position of each of the plurality of subjects is obtained by demodulating, for each of the plurality of parts, the data specified by the pattern of the bright line in the part, and the program further causes the computer to execute estimating a position of the image sensor, based on the obtained position of each of the plurality of subjects.

[0007]

These general and specific aspects may be implemented using

a system, a method, an integrated circuit, a computer program, or a computer-readable recording medium such as a CD-ROM, or any combination of systems, methods, integrated circuits, computer programs, or computer-readable recording media.

Advantageous Effects of Invention

[0008]

An information communication method as per embodiments disclosed herein enables communication between various devices including a device with low computational performance.

Brief Description of Drawings

[0009]

[FIG. 1] FIG. 1 is a diagram illustrating an example of an observation method of luminance of a light emitting unit in Embodiment 1.

[FIG. 2] FIG. 2 is a diagram illustrating an example of an observation method of luminance of a light emitting unit in Embodiment 1.

[FIG. 3] FIG. 3 is a diagram illustrating an example of an observation method of luminance of a light emitting unit in Embodiment 1.

[FIG. 4A] FIG. 4A is a diagram illustrating an example of an observation method of luminance of a light emitting unit in Embodiment 1.

[FIG. 4B] FIG. 4B is a diagram illustrating an example of an observation method of luminance of a light emitting unit in Embodiment 1.

[FIG. 4C] FIG. 4C is a diagram illustrating an example of an observation method of luminance of a light emitting unit in Embodiment 1.

[FIG. 4D] FIG. 4D is a diagram illustrating an example of an observation method of luminance of a light emitting unit in Embodiment 1.

[FIG. 4E] FIG. 4E is a diagram illustrating an example of an

[Claims]

[Claim 1]

An information communication method of obtaining information from a subject, the information communication method comprising:

setting an exposure time of an image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject;

obtaining a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time; and

obtaining the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image,

wherein in the obtaining of a bright line image, the bright line image including a plurality of parts where the bright line appears is obtained by capturing a plurality of the subjects,

in the obtaining of the information, a position of each of the plurality of subjects is obtained by demodulating, for each of the plurality of parts, the data specified by the pattern of the bright line in the part, and

the information communication method further comprises

estimating a position of the image sensor, based on the obtained position of each of the plurality of subjects.

[Claim 2]

The information communication method according to Claim 1,

wherein, in the obtaining of a bright line image, the plurality of subjects are captured in a period during which the image sensor is being moved, and

in the estimating of a position of the image sensor, the position of the image sensor is estimated based on the obtained position of each of the plurality of subjects and a moving state of the image sensor.

[Claim 3]

An information communication device that obtains information from

a subject, the information communication device comprising:

an exposure time setting unit configured to set an exposure time of an image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject;

an image obtainment unit including the image sensor and configured to obtain a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time; and

an information obtainment unit configured to obtain the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image,

wherein the image obtainment unit is configured to obtain the bright line image including a plurality of parts where the bright line appears by capturing a plurality of the subjects,

the information obtainment unit is configured to obtain a position of each of the plurality of subjects by demodulating, for each of the plurality of parts, the data specified by the pattern of the bright line in the part, and

the information communication device further comprises

a position estimation unit configured to estimate a position of the image sensor, based on the obtained position of each of the plurality of subjects.

[Claim 4]

A program for obtaining information from a subject, the program causing a computer to execute:

setting an exposure time of an image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject;

obtaining a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time; and

obtaining the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image,

wherein in the obtaining of a bright line image, the bright line image including a plurality of parts where the bright line appears is obtained by capturing a plurality of the subjects,

in the obtaining of the information, a position of each of the plurality of subjects is obtained by demodulating, for each of the plurality of parts, the data specified by the pattern of the bright line in the part, and

the program further causes the computer to execute

estimating a position of the image sensor, based on the obtained position of each of the plurality of subjects.

CLAIMS

[Claim 1]

An information communication method of obtaining information from a subject, the information communication method comprising:

transmitting position information indicating a position of an image sensor used to capture the subject;

receiving an ID list that is associated with the position indicated by the position information and includes a plurality of sets of identification information;

setting an exposure time of the image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject;

obtaining a bright line image including the bright line, by capturing the subject that changes in luminance by the image sensor with the set exposure time;

obtaining the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image; and

searching the ID list for identification information that includes the obtained information.

[Claim 2]

The information communication method according to Claim 1,

wherein in the case where the identification information that includes the obtained information is not uniquely specified in the searching, the obtaining of a bright line image and the obtaining of the information are repeated to obtain new information, and

the information communication method further comprises

searching the ID list for the identification information that includes the obtained information and the new information.

[Claim 3]

The information communication method according to Claim 1, further comprising:

transmitting the obtained information; and

receiving error notification information for notifying an error, in the case where the identification information that includes the obtained information is not included in the ID list associated with the position indicated by the position information.

[Claim 4]

The information communication method according to Claim 1,

wherein in the obtaining of a bright line image, the bright line image including a plurality of parts where the bright line appears is obtained by capturing a plurality of subjects in a period during which the image sensor is being moved,

in the obtaining of the information, a position of each of the plurality of subjects is obtained by demodulating, for each of the plurality of parts, the data specified by the pattern of the bright line in the part, and

the information communication method further comprises

estimating a position and an imaging direction of the image sensor, based on the obtained position of each of the plurality of subjects and a moving state of the image sensor.

[Claim 5]

The information communication method according to Claim 1,

wherein in the obtaining of a bright line image, the bright line image is obtained by capturing a plurality of subjects reflected on a reflection surface, and

in the obtaining of the information, the information is obtained by separating a bright line corresponding to each of the plurality of subjects from bright lines included in the bright line image according to a strength of the bright line and demodulating, for each of the plurality of subjects, the data specified by the pattern of the bright line corresponding to the subject.

[Claim 6]

The information communication method according to Claim 1, further comprising

obtaining related information associated with the identification information from a server, by transmitting the identification information to the server,

wherein in the obtaining of a bright line image, the subject displaying content that is broadcasted and received is captured,

in the searching, the identification information that includes a channel and a reference time is searched for, the channel being used to broadcast the content displayed by the subject, and the reference time being a time at which the content is displayed, and

in the obtaining of the related information, a plurality of sets of related information associated with the channel and each of the reference time and at least one neighboring time around the reference time are obtained from the server.

[Claim 7]

The information communication method according to Claim 6, further comprising:

obtaining a lighting image by capturing the subject that is lighting without making the change in luminance for signal transmission, the lighting image indicating a lighting range in which the subject is lighting; and

specifying, in the bright line image, a range that is at a same position as the lighting range in the lighting image and has a same size and shape as the lighting range, as a signal transmission range,

wherein in the obtaining of the information, the data specified by the pattern of the bright line included in the specified signal transmission range is demodulated.

[Claim 8]

The information communication method according to Claim 1, further comprising:

determining a pattern of the change in luminance, by modulating a signal to be transmitted; and

transmitting the signal by a display changing in luminance according to the determined pattern while displaying an image, the display being the subject,

wherein in the transmitting of the signal, only a part of the display that is emitting light with predetermined brightness or more to display the image changes in luminance according to the pattern.

[Claim 9]

The information communication method according to Claim 8, wherein the display includes a backlight,

the information communication method further comprises

sequentially displaying, by the display, a left-eye image and a right-eye image lit with given brightness by the backlight, and

the transmitting of the signal and the sequentially displaying are repeated alternately.

[Claim 10]

The information communication method according to Claim 9, further comprising

detecting, by a sensor, a person within a viewing angle of the display or a person near the viewing angle,

wherein in the transmitting of the signal, the signal is transmitted by changing in luminance by a larger change amount in the case where the person near the viewing angle is detected than in the case where the person within the viewing angle is detected, and the transmission of the signal using the change in luminance is stopped in the case where neither the person within the viewing angle nor the person near the viewing angle is detected.

[Claim 11]

The information communication method according to Claim 1, further comprising:

receiving and recording a plurality of images included in

broadcasted content and signals broadcasted respectively in association with the plurality of images, and obtaining related information associated with each of the signals from a server and storing the related information in a recording medium;

determining a pattern of the change in luminance corresponding to each of the signals, by modulating the signal;

transmitting, each time a display which is the subject displays an image included in the recorded content, a signal associated with the image by the display changing in luminance according to the pattern determined for the signal; and

selecting, in the case where a signal associated with one of the plurality of images included in the content is searched for as the identification information in the searching, related information associated with the signal from a plurality of sets of related information stored in the recording medium,

wherein for each of the plurality of images included in the content, a signal broadcasted in association with the image indicates a broadcast time at which the image is broadcasted and a channel used to broadcast the content.

[Claim 12]

The information communication method according to Claim 1, further comprising:

receiving and recording a plurality of images included in broadcasted content and signals broadcasted respectively in association with the plurality of images, and obtaining related information associated with each of the signals from a server and storing the related information in a recording medium;

determining a pattern of the change in luminance corresponding to each of the signals, by modulating the signal;

transmitting, each time a display which is the subject displays an image included in the recorded content, a signal associated with the image by the display changing in luminance according to the pattern determined for the signal; and

selecting, in the case where a signal associated with one of the

plurality of images included in the content is searched for as the identification information in the searching, related information associated with the signal from a plurality of sets of related information stored in the recording medium,

wherein for each of the plurality of images included in the content, a signal broadcasted in association with the image indicates image identification information for identifying the image in the content.

[Claim 13]

An information communication device that obtains information from a subject, the information communication device comprising:

a position information transmission unit configured to transmit position information indicating a position of an image sensor used to capture the subject;

a list reception unit configured to receive an ID list that is associated with the position indicated by the position information and includes a plurality of sets of identification information;

an exposure time setting unit configured to set an exposure time of the image sensor so that, in an image obtained by capturing the subject by the image sensor, a bright line corresponding to an exposure line included in the image sensor appears according to a change in luminance of the subject;

an image obtainment unit including the image sensor and configured to obtain a bright line image including the bright line, by capturing the subject that changes in luminance with the set exposure time;

an information obtainment unit configured to obtain the information by demodulating data specified by a pattern of the bright line included in the obtained bright line image; and

a search unit configured to search the ID list for identification information that includes the obtained information.