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(54) **DISPLAY DEVICE AND DISPLAY CONTROL METHOD**

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(57) **ABSTRACT**

A display device includes a first storage configured to store post-processing parameter information obtained by processing parameter information indicating parameters for causing a light source device to appropriately emit light, a second storage configured to store processing information specific to the light source device, a processor configured to process the post-processing parameter information stored in the first storage into pre-processing parameter information based on the processing information stored in the second storage, and a light source controller configured to cause the light source device to emit light based on the pre-processing parameter information processed by the processor.

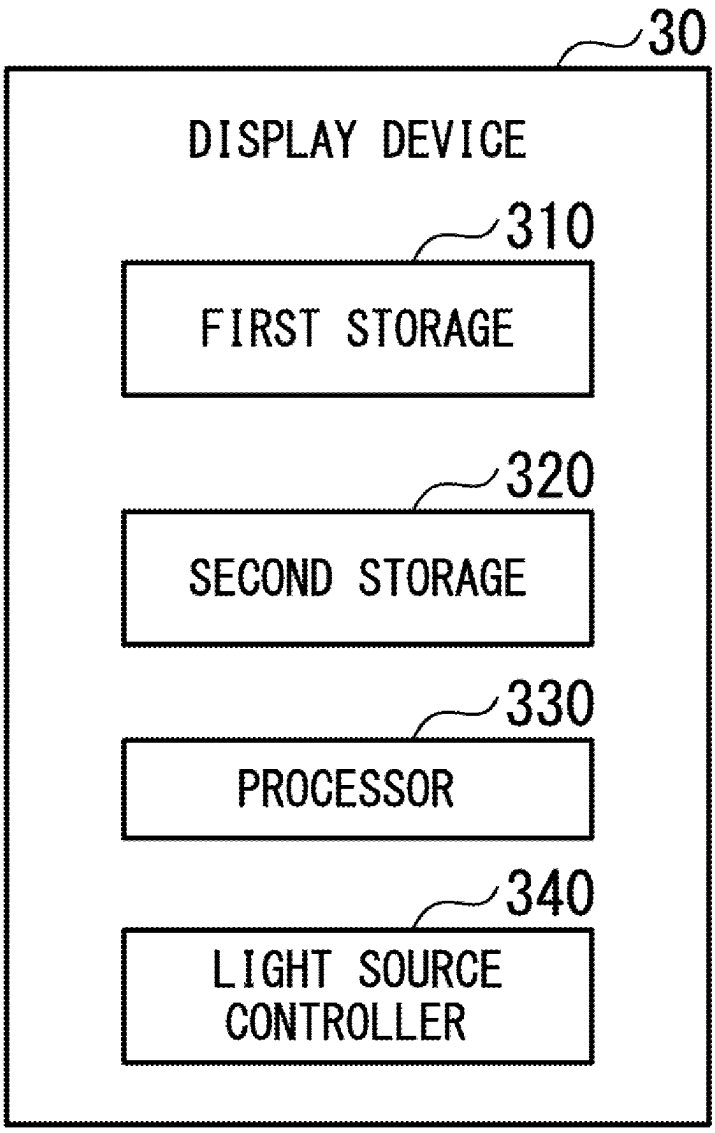


FIG. 1

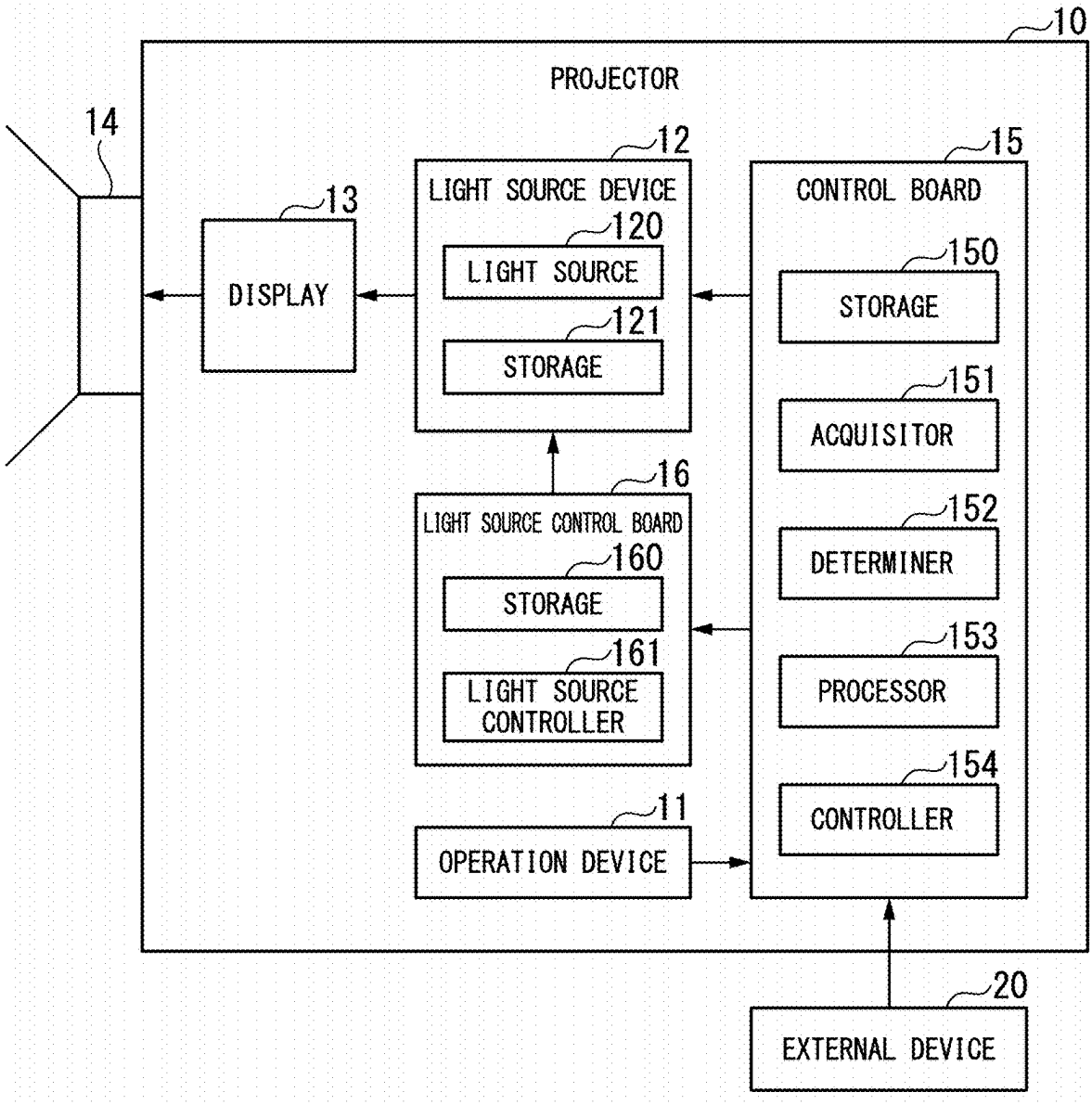

10
PROJECTOR
14
12
LIGHT SOURCE DEVICE
120
LIGHT SOURCE
121
STORAGE
13
DISPLAY
15
CONTROL BOARD
150
STORAGE
151
ACQUISITOR
152
DETERMINER
153
PROCESSOR
154
CONTROLLER
16
LIGHT SOURCE CONTROL BOARD
160
STORAGE
161
LIGHT SOURCE CONTROLLER
11
OPERATION DEVICE
20
EXTERNAL DEVICE

FIG. 2

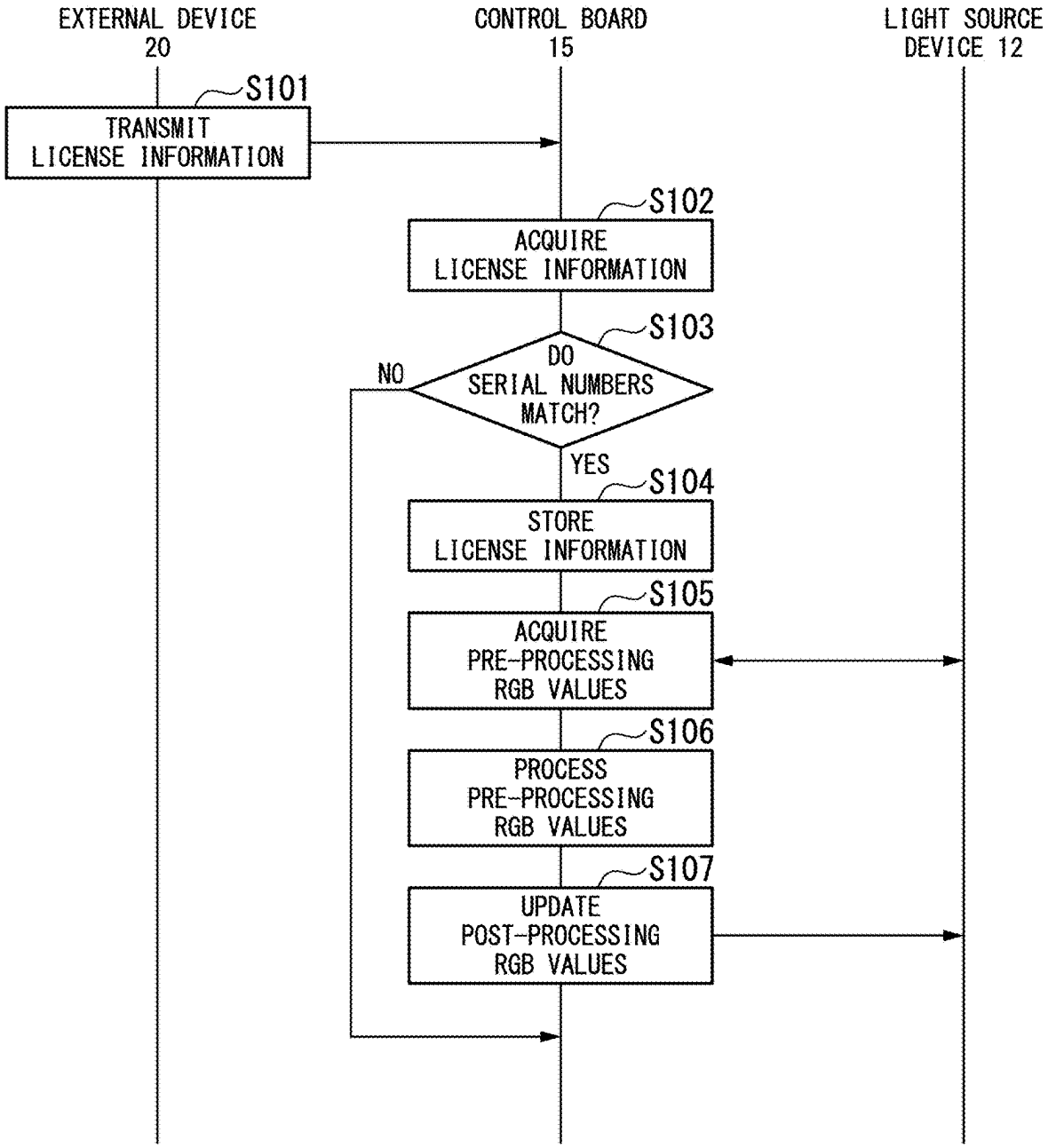

EXTERNAL DEVICE
20
CONTROL BOARD
15
LIGHT SOURCE
DEVICE 12
S101
TRANSMIT
LICENSE INFORMATION
S102
ACQUIRE
LICENSE INFORMATION
S103
DO
SERIAL NUMBERS
MATCH?
NO
YES
S104
STORE
LICENSE INFORMATION
S105
ACQUIRE
PRE-PROCESSING
RGB VALUES
S106
PROCESS
PRE-PROCESSING
RGB VALUES
S107
UPDATE
POST-PROCESSING
RGB VALUES

FIG. 3

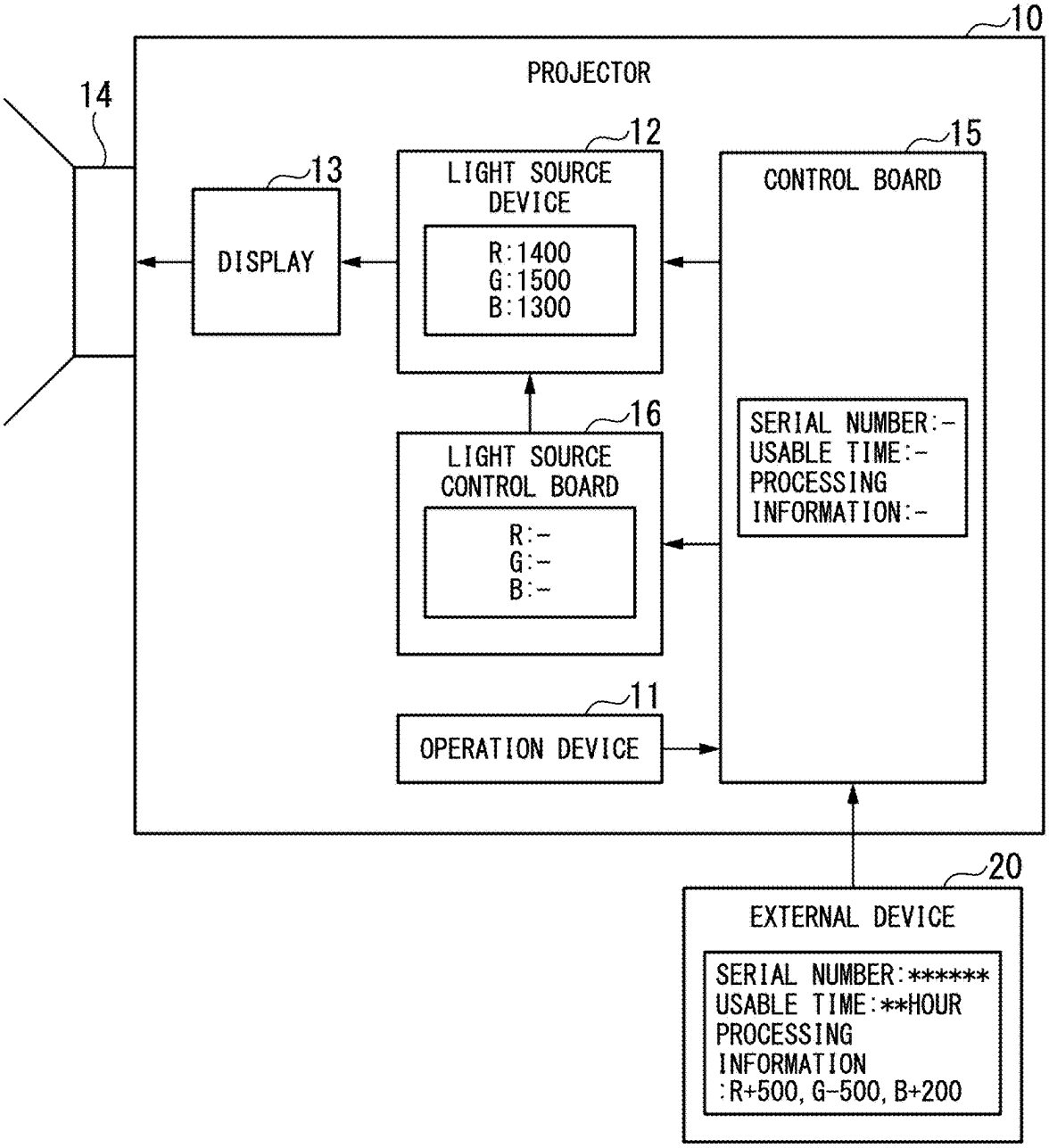

10
PROJECTOR
14
12
LIGHT SOURCE DEVICE
R:1400
G:1500
B:1300
15
CONTROL BOARD
13
DISPLAY
16
LIGHT SOURCE CONTROL BOARD
R:-
G:-
B:-
SERIAL NUMBER:-
USABLE TIME:-
PROCESSING INFORMATION:-
11
OPERATION DEVICE
20
EXTERNAL DEVICE
SERIAL NUMBER:******
USABLE TIME:**HOUR
PROCESSING INFORMATION
:R+500, G-500, B+200

FIG. 4

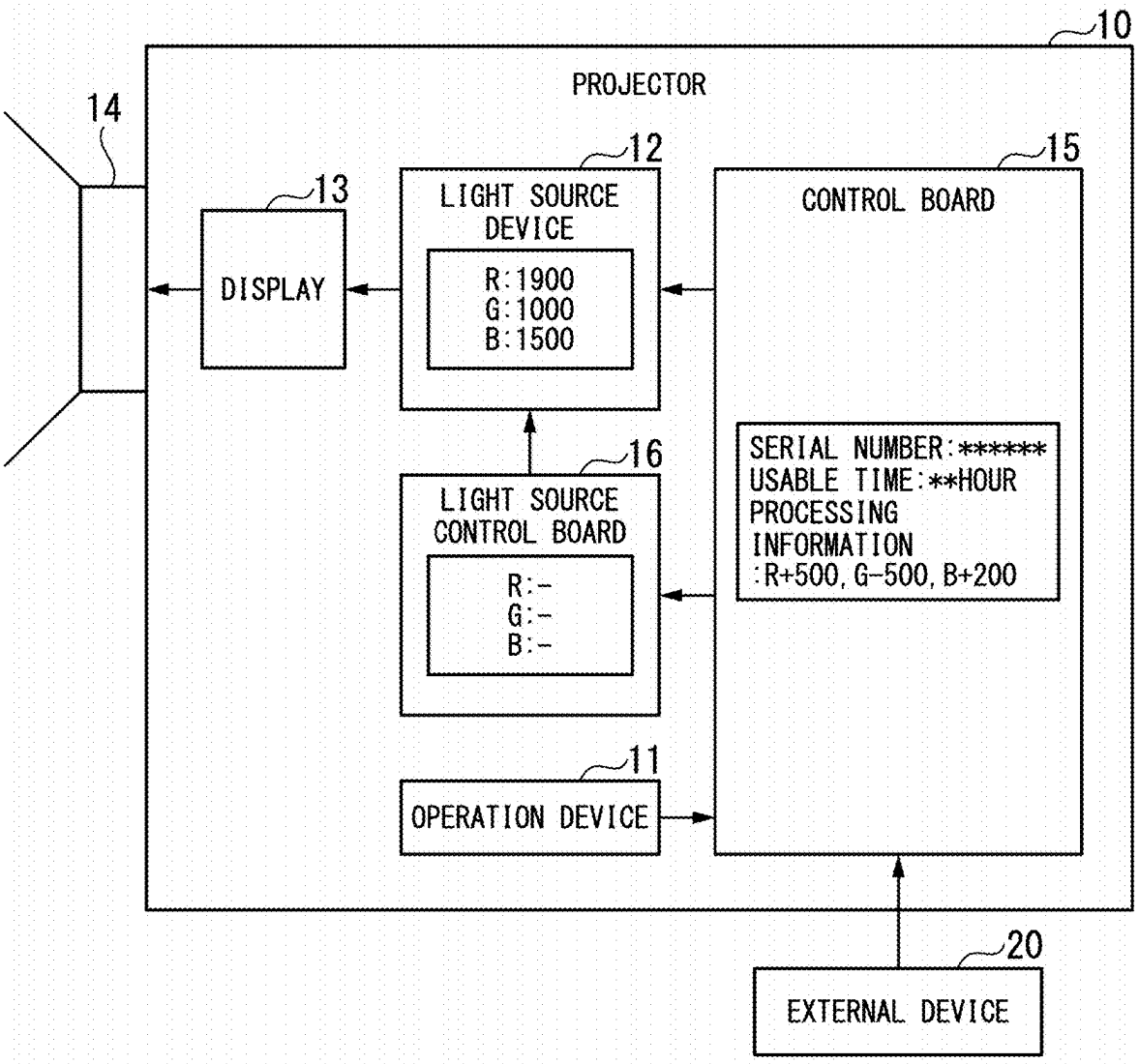

10
PROJECTOR
14
12
LIGHT SOURCE DEVICE
R:1900
G:1000
B:1500
15
CONTROL BOARD
13
DISPLAY
16
LIGHT SOURCE CONTROL BOARD
R:-
G:-
B:-
SERIAL NUMBER:******
USABLE TIME:**HOUR
PROCESSING INFORMATION
:R+500, G-500, B+200
11
OPERATION DEVICE
20
EXTERNAL DEVICE

FIG. 5

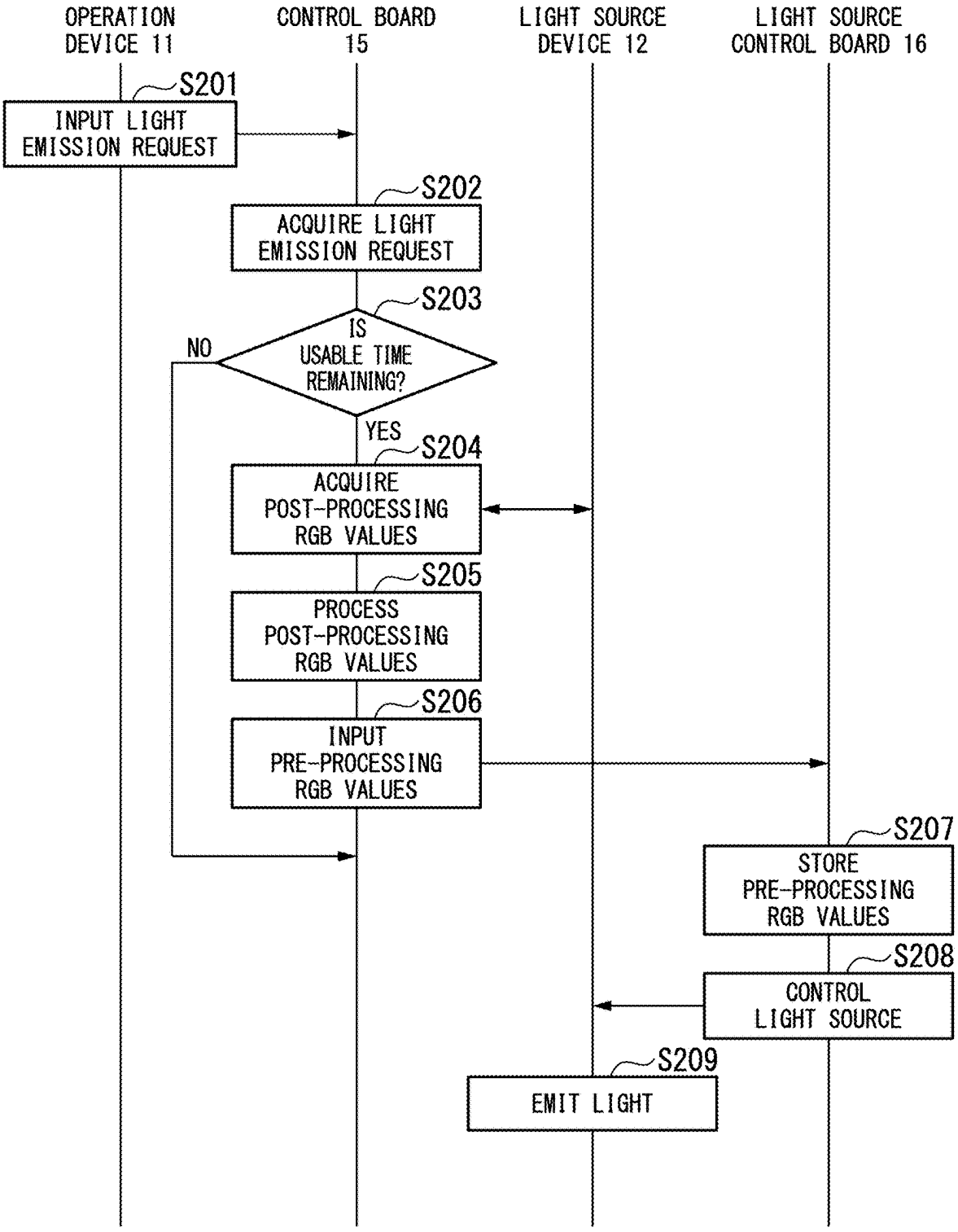

OPERATION DEVICE 11
CONTROL BOARD 15
LIGHT SOURCE DEVICE 12
LIGHT SOURCE CONTROL BOARD 16
S201
INPUT LIGHT EMISSION REQUEST
S202
ACQUIRE LIGHT EMISSION REQUEST
S203
IS USABLE TIME REMAINING?
NO
YES
S204
ACQUIRE POST-PROCESSING RGB VALUES
S205
PROCESS POST-PROCESSING RGB VALUES
S206
INPUT PRE-PROCESSING RGB VALUES
S207
STORE PRE-PROCESSING RGB VALUES
S208
CONTROL LIGHT SOURCE
S209
EMIT LIGHT

FIG. 6

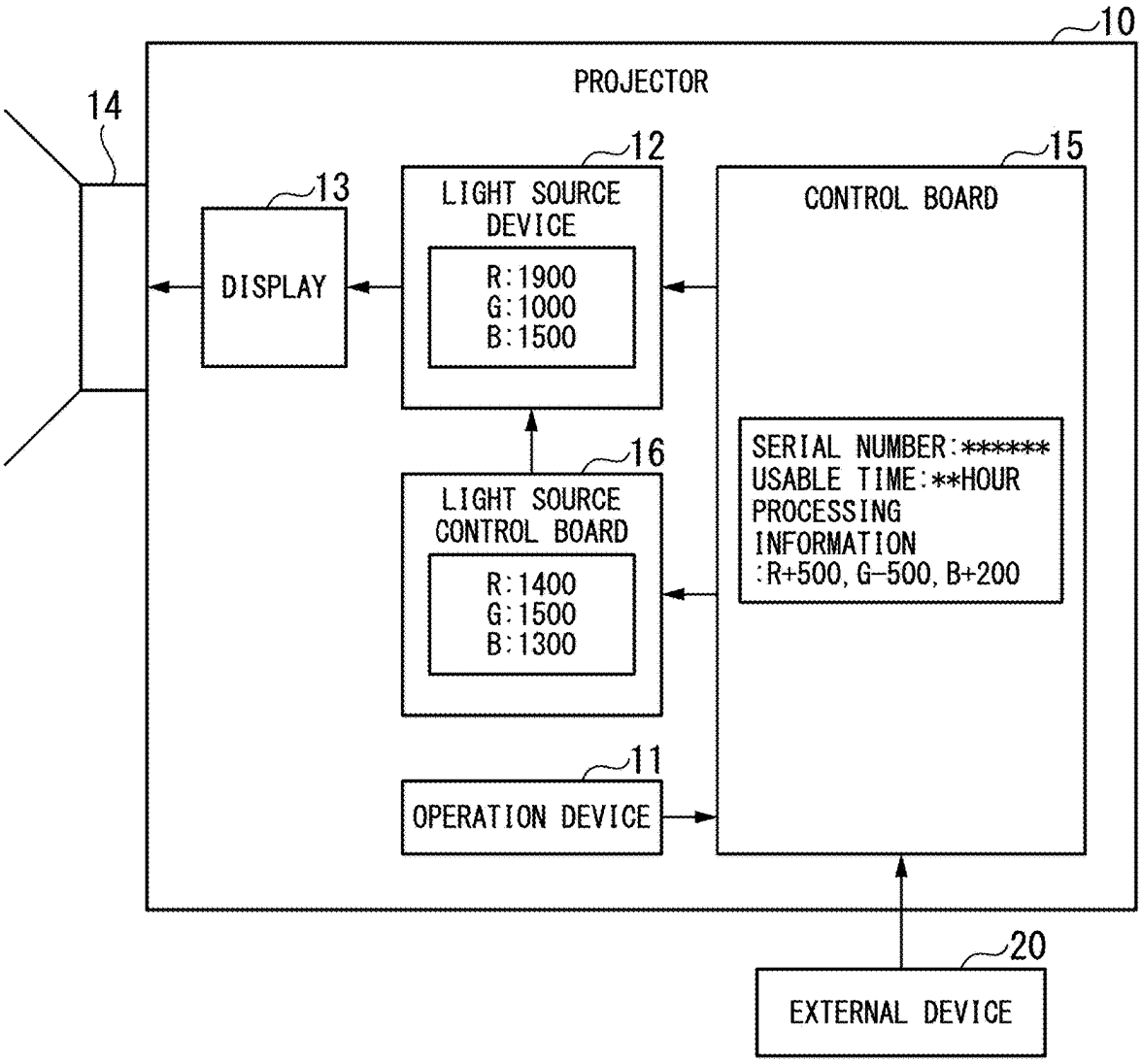

10
PROJECTOR
14
12
LIGHT SOURCE DEVICE
R:1900
G:1000
B:1500
15
CONTROL BOARD
13
DISPLAY
16
LIGHT SOURCE CONTROL BOARD
R:1400
G:1500
B:1300
SERIAL NUMBER:******
USABLE TIME:**HOUR
PROCESSING INFORMATION
:R+500, G-500, B+200
11
OPERATION DEVICE
20
EXTERNAL DEVICE

FIG. 7

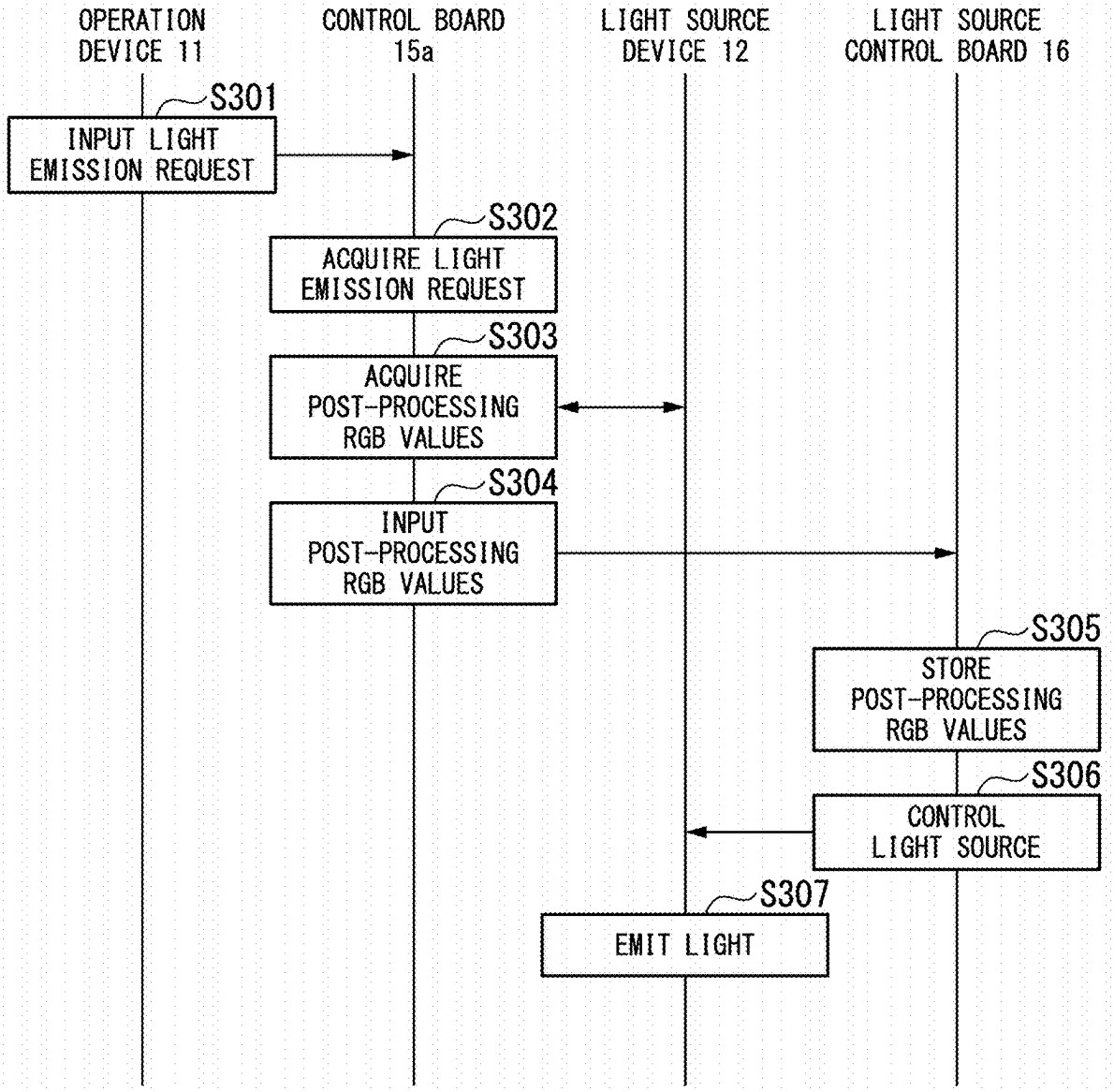

OPERATION DEVICE 11
CONTROL BOARD 15a
LIGHT SOURCE DEVICE 12
LIGHT SOURCE CONTROL BOARD 16
S301
INPUT LIGHT EMISSION REQUEST
S302
ACQUIRE LIGHT EMISSION REQUEST
S303
ACQUIRE POST-PROCESSING RGB VALUES
S304
INPUT POST-PROCESSING RGB VALUES
S305
STORE POST-PROCESSING RGB VALUES
S306
CONTROL LIGHT SOURCE
S307
EMIT LIGHT

FIG. 8

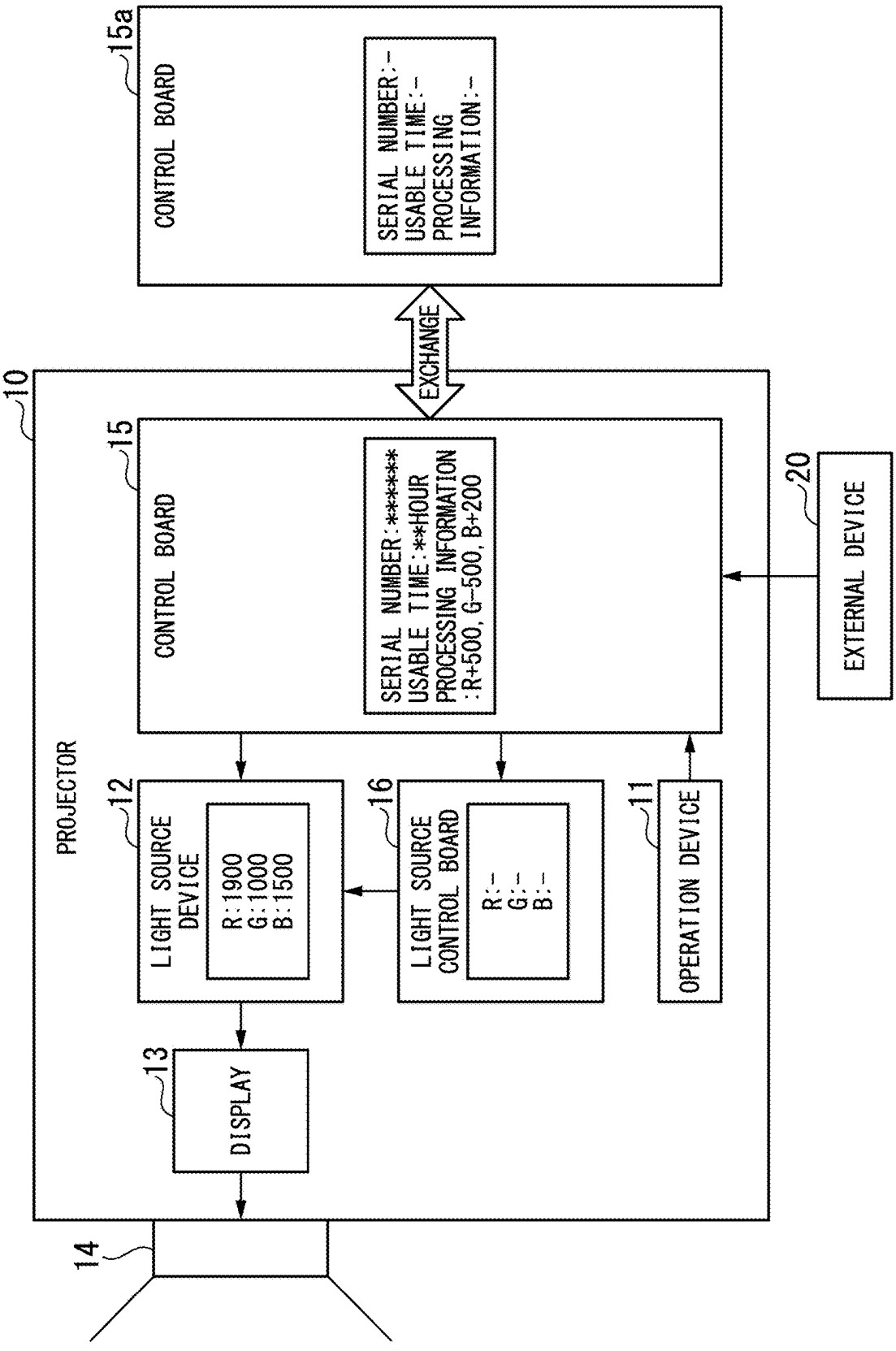

15a
CONTROL BOARD
SERIAL NUMBER:-
USABLE TIME:-
PROCESSING INFORMATION:-
EXCHANGE
10
15
CONTROL BOARD
SERIAL NUMBER:******
USABLE TIME:**HOUR
PROCESSING INFORMATION
:R+500, G-500, B+200
20
EXTERNAL DEVICE
PROJECTOR
12
LIGHT SOURCE DEVICE
R:1900
G:1000
B:1500
16
LIGHT SOURCE CONTROL BOARD
R:-
G:-
B:-
11
OPERATION DEVICE
13
DISPLAY
14

FIG. 9

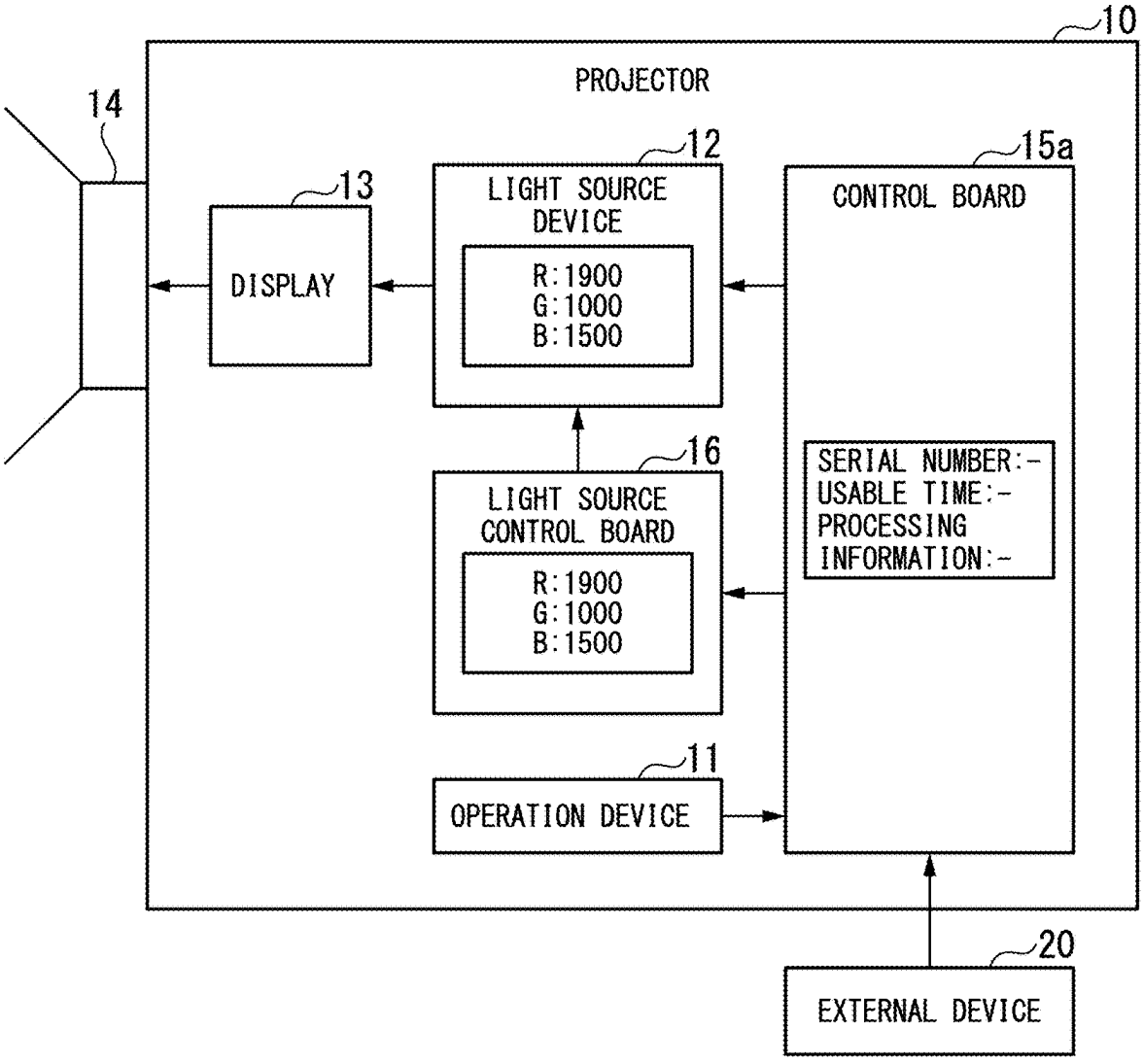
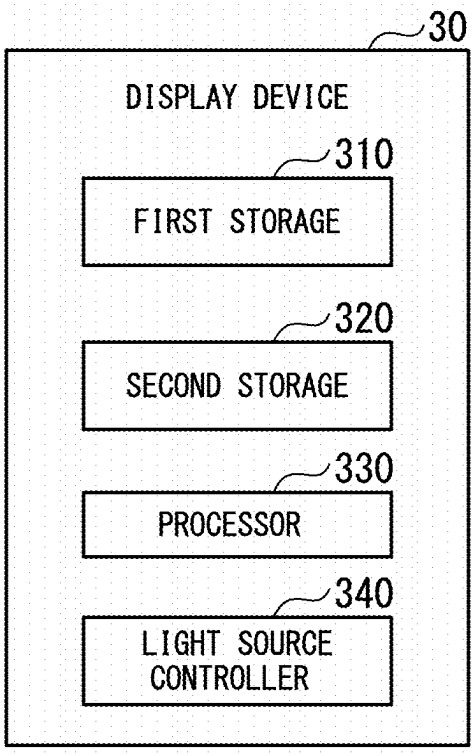

10
PROJECTOR
14
12
LIGHT SOURCE DEVICE
R:1900
G:1000
B:1500
15a
CONTROL BOARD
13
DISPLAY
16
LIGHT SOURCE CONTROL BOARD
R:1900
G:1000
B:1500
SERIAL NUMBER:-
USABLE TIME:-
PROCESSING INFORMATION:-
11
OPERATION DEVICE
20
EXTERNAL DEVICE

FIG. 10


30
DISPLAY DEVICE
310
FIRST STORAGE
320
SECOND STORAGE
330
PROCESSOR
340
LIGHT SOURCE CONTROLLER

DISPLAY DEVICE AND DISPLAY CONTROL METHOD

TECHNICAL FIELD

[0001] The present invention relates to a display device and a display control method.

BACKGROUND ART

[0002] In recent years, as a method of purchasing a projector, a method of purchasing a license according to an amount of time the projector is to be used, instead of purchasing the projector itself at a regular price, has been provided. In this method, the purchaser pays in advance an amount of money according to the amount of time the projector is to be used, and purchases a license that allows the projector to be used for that amount of time. The seller provides the purchaser with a projector that has the license purchased by the purchaser written to it. This allows the purchaser to use the projector for the amount of time the license is purchased.

[0003] In this manner, a function of allowing the projector to be used based on a license can also be implemented for existing projectors that can be used even without licenses written to them. However, when a component that has a license and software for executing this function written to it is replaced with a component that does not have the license and software written to it, it becomes possible to use the projector while ignoring a usable time indicated by the license.

[0004] Therefore, various technologies have been proposed that detect replacement of a component to disable a use of the projector. For example, Patent Document 1 listed below discloses a technology that, when it is detected that a projection light source in a projector has been replaced with a projection light source that is not a genuine standard product, controls the projector so that the light cannot be turned on.

CITATION LIST

Patent Document

[0005] Patent Document 1: Japanese Unexamined Patent Application, First Publication No. 2008-185712

SUMMARY OF INVENTION

Technical Problem

[0006] However, with the technology of Patent Document 1, when the replaced component of the projector is a genuine standard component, the projector can be used illegally even if the component does not have a license written to it.

[0007] In consideration of the problems described above, an object of the present invention is to provide a display device and a display control method that can prevent unauthorized use.

Solution to Problem

[0008] To solve the problems described above, a display device according to one aspect of the present invention includes a first storage configured to store post-processing parameter information obtained by processing parameter information indicating parameters for causing a light source device to appropriately emit light, a second storage configured to store processing information specific to the light source device, a processor configured to process the post-processing parameter information stored in the first storage into pre-processing parameter information based on the processing information stored in the second storage, and a light source controller configured to cause the light source device to emit light based on the pre-processing parameter information processed by the processor.

[0009] A display control method according to another aspect of the present invention includes a first storage process for storing post-processing parameter information obtained by processing parameter information indicating parameters for causing a light source device to appropriately emit light, a second storage process for storing processing information specific to the light source device, a processing process for processing the post-processing parameter information stored in the first storage into pre-processing parameter information based on the processing information stored in the second storage, and a light source control process for causing the light source device to emit light based on the pre-processing parameter information processed by the processor.

Advantageous Effects of Invention

[0010] According to the present invention, it is possible to prevent unauthorized use of a display device.

BRIEF DESCRIPTION OF DRAWINGS

[0011] FIG. **1** A diagram representing an example of a configuration of a projector according to a first embodiment.

[0012] FIG. **2** A sequence diagram representing an example of a processing flow from registration of license information to processing of RGB values according to the first embodiment.

[0013] FIG. **3** A diagram representing an example of information stored in each storage in an initial state according to the first embodiment.

[0014] FIG. **4** A diagram representing an example of information stored in each storage after processing of RGB values according to the first embodiment.

[0015] FIG. **5** A sequence diagram representing an example of a processing flow from an input of a light emission request to light emission by the light source device according to the first embodiment.

[0016] FIG. **6** A diagram representing an example of information stored in each storage when the light source device emits light according to the first embodiment.

[0017] FIG. **7** A sequence diagram representing an example of a processing flow from an input of a light emission request to light emission by the light source device after replacement of a control board according to the first embodiment.

[0018] FIG. **8** A diagram representing an example of information stored in each storage when the control board is replaced according to the first embodiment.

[0019] FIG. **9** A diagram representing an example of information stored in each storage after the replacement of the control board according to the first embodiment and when the light source device emits light.

[0020] FIG. **10** A diagram representing an example of a configuration of a display device according to a second embodiment.

DESCRIPTION OF EMBODIMENTS

[0021] Hereinafter, embodiments of the present invention will be described in detail with reference to the drawings.

[0022] In the present embodiment, a display device will be described using, as an example, a service in which a user can use a display device by purchasing a license instead of purchasing the display device itself at a regular price. In this service, a manufacturer of the display device sells the display device at a regular price to a business person providing the service (hereinafter also referred to as a "service provider"). The service provider sells the license of the display device purchased from the manufacturer to the user. The user purchases the license from the service provider according to an amount of time the display device is to be used. At this time, the user pays the service provider an amount of money according to the amount of time the display device is to be used. When the user purchases the license, the service provider writes information indicating the license that allows the display device to be used (hereinafter also referred to as "license information") to the display device. As a result, the display device will be available for the amount of time for which the user purchases the license and be provided to the user.

[0023] In the following description, as an example, an example where the display device is a projector will be described.

1. First Embodiment

[0024] First, a first embodiment of the present invention will be described with reference to FIG. **1** to FIG. **9**.

1-1. Configuration of Projector

[0025] A configuration of a projector according to the first embodiment will be described with reference to FIG. **1**. FIG. **1** is a diagram which shows an example of the configuration of the projector according to the first embodiment of the present invention. As shown in FIG. **1**, the projector **10** includes an operation device **11**, a light source device **12**, a display **13**, a lens **14**, a control board **15** (a first board), and a light source control board **16** (a second board).

(1) Operation Device **11**

[0026] The operation device **11** receives an input from a user. Examples of the operation device **11** include keys and buttons arranged on the projector **10**, a remote controller, and various pointing devices. The user operates the operation device **11** to perform an input for operating the projector **10**. For example, the user inputs an operation to cause the projector **10** to emit light (hereinafter also referred to as a "light emission operation"). When a light emission operation is performed, the operation device **11** inputs a light emission request to the control board **15**.

(2) Light Source Device **12**

[0027] The light source device **12** is a device that emits light and irradiates with light.

[0028] As shown in FIG. **1**, the light source device **12** includes a light source **120** and a storage **121** (a first storage).

(2-1) Light Source **120**

[0029] The light source **120** has, for example, a laser, a mercury lamp, a light emitting diode, or the like as a light source. In the following description, as an example, a case where the light source **120** has an RGB laser as a light source will be described. When an instruction to emit light is received, the light source **120** emits light and irradiates the display **13** with the emitted light. The light emission instruction is input from the light source control board **16**.

(2-2) Storage **121**

[0030] The storage **121** stores parameter information indicating parameters for the light source device **12** to emit light appropriately. The parameter information is, for example, RGB values set so that the light source device **12** emits light with an appropriate white balance. The parameter information is information specific to the light source device **12**. The parameter information is registered in the storage **121** by a manufacturer when the projector **10** is manufactured.

(3) Display **13**

[0031] The display **13** generates a display image based on a video signal and the light emitted by the light source **120**, and displays it on a display panel such as a liquid crystal panel.

(4) Lens **14**

[0032] The lens **14** is an electric lens or a manual lens. The lens **14** projects the display image generated by the display **13** onto a projection surface.

(5) Control Board **15**

[0033] The control board **15** is a board that controls an overall operation of the projector **10**.

[0034] As shown in FIG. **1**, the control board **15** includes a storage **150** (a second storage), an acquisitor **151**, a determiner **152**, a processor **153**, and a controller **154**.

(5-1) Storage **150**

[0035] The storage **150** stores various types of information. The storage **150** stores a serial number, which is information for uniquely identifying the projector **10** and is information specific to the projector **10**. In addition, the storage **150** stores software that controls an operation of the projector **10**. The serial number and software are written to the storage **150** by the manufacturer when the projector **10** is manufactured.

[0036] The storage **150** also stores license information indicating a license that allows the projector **10** to be used. The license information is written to the storage **150** by a service provider after the user purchases the license. The service provider writes the license information to the storage **150**, for example, using an external device **20** connected to the projector **10**.

[0037] The license information is information including, for example, a serial number, usable time, and processing information. The serial number included in the license information is a serial number of the projector **10** that is allowed to be used by license. The usable time is information indicating an amount of time the projector **10** can be used. The processing information is information for processing the parameter information. The processing information is information specific to the light source device **12**.

(5-2) Acquisitor **151**

[0038] The acquisitor **151** acquires various types of information. For example, the acquisitor **151** acquires license information transmitted from the external device **20**. The acquisitor **151** also acquires the parameter information from the storage **121** of the light source device **12**. The acquisitor **151** also acquires a light emission request from the operation device **11**.

(5-3) Determiner **152**

[0039] The determiner **152** determines whether to execute writing of the license information to the storage **150**. The determiner **152** checks whether a serial number included in the license information acquired by the acquisitor **151** matches a serial number stored in the storage **150**. When the serial numbers match, it can be said that the projector **10** that has the license information written thereto is correct. In this case, the determiner **152** determines to write the license information to the storage **150**. On the other hand, when the serial numbers do not match, it can be said that the projector **10** that has written the license information is not correct. In this case, the determiner **152** determines not to write the license information to the storage **150**.

[0040] In addition, the determiner **152** determines whether the projector **10** is usable based on the license information. For example, when there is a light emission request, the determiner **152** refers to the usable time of the license information stored in the storage **150**, and determines to emit light when there is usable time remaining. On the other hand, when there is no usable time remaining, the determiner **152** determines not to emit light.

(5-4) Processor **153**

[0041] The processor **153** processes the parameter information stored in the storage **121** based on the processing information stored in the storage **150**.

[0042] For example, the processor **153** processes the parameter information stored in advance in the storage **121** using the processing information. The parameter information stored in advance in the storage **121** and in a state before being processed by the processing information is also referred to as "pre-processing parameter information" below. The parameter information in a state after being processed by the processing information is also referred to as "post-processing parameter information" below. The processor **153** processes the post-processing parameter information stored in the storage **121** using the processing information, and processes (returns) the post-processing parameter information to the pre-processing parameter information. The pre-processing parameter information obtained by being processed using correct processing information is identical to the parameter information stored in advance in the storage **121**.

[0043] As an example, when the license information is written (stored) to the storage **150** by the service provider, the processor **153** acquires the pre-processing parameter information stored in advance in the storage **121** and processes the information using the processing information included in the license information. After processing, the processor **153** overwrites the pre-processing parameter information stored in the storage **121** with the post-processing parameter information.

[0044] Moreover, when there is a request for the light source device **12** to emit light, the processor **153** returns the post-processing parameter information stored in the storage **121** to the pre-processing parameter information based on the processing information stored in the storage **150**, and inputs the pre-processing parameter information to the light source control board **16**.

(5-5) Controller **154**

[0045] The controller **154** controls an overall operation of the projector **10**. The controller **154** is realized by, for example, causing a central processor (CPU) provided as hardware in the control board **15** to execute a program.

(6) Light Source Control Board **16**

[0046] The light source control board **16** is a board that controls an operation of the light source device **12**.

[0047] As shown in FIG. **1**, the light source control board **16** includes a storage **160** and a light source controller **161**.

(6-1) Storage **160**

[0048] The storage **160** stores parameter information for controlling the light source device **12**. For example, the storage **160** stores pre-processing parameter information input from the processor **153** of the control board **15**.

(6-2) Light Source Controller **161**

[0049] The light source controller **161** controls the operation of the light source device **12**. The light source controller **161** is realized by, for example, causing the CPU provided as hardware in the light source control board **16** to execute a program.

[0050] For example, the light source controller **161** controls a light emission from the light source device **12** based on the parameter information processed by the processor **153**. Specifically, the light source controller **161** controls parameters of the light source device **12** that emits light so that they become parameters indicated by the pre-processing parameter information input from the processor **153** (stored in the storage **160**).

1-2. Processing Flow

[0051] A functional configuration of the projector **10** according to the first embodiment has been described above. Next, a processing flow according to the first embodiment will be described with reference to FIGS. **2** to **9**. Note that, in the following description, description of processing for a manufacturing of the projector **10** by the manufacturer, a sale of license by the service provider, and a purchase of license by the user will be omitted, and description will start with processing of registration of license information by the service provider.

(1) Processing Flow from Registration of License Information to Processing of RGB Values

[0052] A processing flow from a registration of license information to processing of RGB values will be described with reference to FIGS. **2** to **4**. FIG. **2** is a sequence diagram which shows an example of the processing flow from the registration of license information to the processing of RGB values according to the first embodiment. FIG. **3** is a diagram which shows an example of information stored in each storage in the initial state according to the first embodi-

ment. FIG. **4** is a diagram which shows an example of information stored in each storage after the processing of RGB values according to the first embodiment.

[0053] First, the service provider uses the external device **20** to write the license information to the projector **10** in an initial state in which the user has purchased a license. As a result, as shown in FIG. **2**, the license information is transmitted from the external device **20** to the control board **15** (step S**101**).

[0054] FIG. **3** shows the initial state of the projector **10**. The initial state of the projector **10** is a state before the service provider purchases the projector **10** from the manufacturer and writes license information to the projector **10**. In the initial state of the projector **10**, RGB values are stored as parameter information in the storage **121** of light source device **12**, and the license information of the storage **150** of the control board **15** and parameter information of the storage **160** of light source control board **16** are empty. FIG. **3** shows, as an example, an example in which R is 1400, G is 1500, and B is 1300 among the RGB values stored in storage **121** of the light source device **12**. FIG. **3** also shows, as an example, an example in which the license information transmitted from the external device **20** has a serial number of "******," a usable time of "** hours," and processing information of "R+500, G−500, B+200."

[0055] In the control board **15**, the acquisitor **151** acquires the license information transmitted from the external device **20** (step S**102**).

[0056] Next, the determiner **152** checks whether the serial number included in the license information acquired by the acquisitor **151** matches the serial number stored in the storage **150** (step S**103**). When the serial numbers match (YES in step S**103**), the determiner **152** determines to write the license information to the storage **150**. According to this determination, the storage **150** stores the license information (step S**104**). On the other hand, when the serial numbers do not match (NO in step S**103**), the determiner **152** determines not to write the license information to the storage **150**. According to this determination, the storage **150** does not store the license information and processing ends.

[0057] After the license information is stored, the processor **153** acquires pre-processing RGB values (parameter information) from the storage **121** of the light source device **12** (step S**105**).

[0058] The processor **153** then processes the acquired pre-processing RGB values using the processing information (step S**106**). For example, the processor **153** processes the pre-processing RGB values "R: 1400, G: 1500, B: 1300" stored in the storage **121** of the light source device **12** using the processing information "R+500, G−500, B+200." In this case, it is assumed that post-processing RGB values become "R: 1400+500=1900, G: 1500−500=1000, B: 1300+200=1500."

[0059] After processing, the processor **153** overwrites the pre-processing RGB values stored in the storage **121** of the light source device **12** with the post-processing RGB values to update them (step S**107**).

[0060] FIG. **4** shows a state of the projector **10** after step S**107**. As shown in FIG. **4**, the RGB values stored in the storage **121** of the light source device **12** are "R: 1900, G: 1000, B: 1500." In addition, the storage **150** of the control board **15** stores license information with a serial number of "******," usable time of "** hours," and processing information of "R+500, G−500, B+200." The parameter information of the storage **160** of the light source control board **16** remains empty.

(2) Processing Flow from Input of Light Emission Request to Light Emission of Light Source Device

[0061] A processing flow from an input of a light emission request to a light emission of the light source device **12** will be described with reference to FIG. **5** and FIG. **6**. FIG. **5** is a sequence diagram which shows an example of a processing flow from the input of a light emission request to the light emission of the light source device **12** according to the first embodiment. FIG. **6** is a diagram which shows an example of information stored in each storage when the light source device **12** emits light according to the first embodiment.

[0062] When a user who has been provided with the projector **10** in the state shown in FIG. **4** by the service provider uses the projector **10**, the user inputs a light emission operation to the operation device **11** of the projector **10**. As a result, as shown in FIG. **5**, a light emission request is input from the operation device **11** to the control board **15** (step S**201**).

[0063] In the control board **15**, the acquisitor **151** acquires the light emission request input from the operation device **11** (step S**202**).

[0064] The determiner **152** then checks whether the usable time of the license information stored in the storage **150** remains (step S**203**). When there is usable time remaining (YES in step S**203**), the determiner **152** determines to emit light and proceeds to step S**204**. On the other hand, when there is no usable time remaining (NO in step S**203**), the determiner **152** determines not to emit light and ends the processing.

[0065] When the processing proceeds to step S**204**, the processor **153** acquires the post-processing RGB values from the storage **121** of the light source device **12** (step S**204**).

[0066] The processor **153** then processes the acquired post-processing RGB values using the processing information (step S**205**). For example, the processor **153** returns the post-processing RGB values "R: 1900, G: 1000, B: 1500" stored in the storage **121** of the light source device **12** to the pre-processing RGB values using the processing information "R+500, G−500, B+200." In this case, the processor **153** calculates the pre-processing RGB values as follows: "R: 1900−500=1400, G: 1000+500=1500, B: 1500−200=1300."

[0067] After the processing, the processor **153** inputs the pre-processing RGB values to the light source control board **16** (step S**206**).

[0068] The storage **160** of the light source control board **16** stores the pre-processing RGB values input from the processor **153** as parameter information (step S**207**).

[0069] The light source controller **161** then controls the light source device **12** so that it has the pre-processing RGB values stored in the storage **160** (step S**208**).

[0070] The light source device **12** emits light from the light source **120** in accordance with the control of the light source controller **161** (step S**209**).

[0071] FIG. **6** shows the state of the projector **10** after step S**209**. As shown in FIG. **6**, the RGB values stored in the storage **121** of the light source device **12** remain "R: 1900, G: 1000, B: 1500." The storage **150** of the control board **15** stores license information with a serial number of "******," usable time of "** hours," and processing information of

"R+500, G−500, B+200." The RGB values stored in the storage **160** of the light source control board **16** are "R: 1400, G: 1500, B: 1300."

(3) Processing Flow after Replacement of Control Board

[0072] A processing flow after replacement of the control board **15** will be described with reference to FIGS. **7** to **9**. FIG. **7** is a sequence diagram which shows an example of a processing flow from an input of a light emission request to light emission of the light source device **12** after replacement of the control board **15** according to the first embodiment. FIG. **8** is a diagram which shows an example of information stored in each storage when the control board **15** is replaced according to the first embodiment. FIG. **9** is a diagram which shows an example of information stored in each storage when the control board **15** is replaced according to the first embodiment and then the light source device **12** emits light.

[0073] A user who has been provided with the projector **10** in the state shown in FIG. **4** by the service provider replaces the control board **15** with a control board **15***a* with no software or serial information as shown in FIG. **8** before using the projector **10**. In other words, it is assumed that the user has illegally replaced the control board **15**. After the replacement, the user inputs a light emission operation to the operation device **11** of the projector **10**. As a result, a light emission request is input from the operation device **11** to the control board **15***a* as shown in FIG. **7** (step S**301**).

[0074] In the control board **15***a*, the acquisitor **151** acquires the light emission request input from the operation device **11** (step S**302**).

[0075] Note that, unlike the control board **15**, the control board **15***a* does not store software and license information, and therefore does not check the usable time or process RGB values.

[0076] For this reason, the control board **15***a* acquires the post-processing RGB values from the storage **121** of the light source device **12** (step S**303**) and inputs the acquired post-processing RGB values to the light source control board **16** as they are (step S**304**).

[0077] The storage **160** of the light source control board **16** stores the post-processing RGB values input from the control board **15***a* as parameter information (step S**305**).

[0078] The light source controller **161** then controls the light source device **12** so that it has the post-processing RGB values stored in the storage **160** (step S**306**).

[0079] The light source device **12** emits light from the light source **120** in accordance with the control of the light source controller **161** (step S**307**).

[0080] FIG. **9** shows the state of the projector **10** after step S**307**. As shown in FIG. **9**, the RGB values stored in the storage **121** of the light source device **12** remain as "R: 1900, G: 1000, B: 1500." The license information of the control board **15***a* is empty. The RGB values stored in the storage **160** of the light source control board **16** are "R: 1900, G: 1000, B: 1500."

[0081] In this manner, when the control board **15** is illegally replaced, the light source control board **16** controls the light source device **12** so that it has the post-processing RGB values. As a result, the light source device **12** cannot output light of a correct color. As a result, the projector **10** cannot output images normally.

[0082] Note that in FIGS. **7** to **9**, an example is described in which the control board **15** is replaced with a control board **15***a* on which software and license information are not written, but the present invention is not limited to such an example. For example, it is assumed that the control board **15** is replaced with a control board on which software and license information are written. In this case, the license information contains processing information (that is, incorrect processing information) that is different from processing information specific to the light source device **12**. For this reason, a processor of the replaced control board cannot correctly return the post-processing RGB values to the pre-processing RGB values, and the light source control board **16** controls the light source device **12** so that the RGB values are not correct. For this reason, the light source device **12** cannot output light of a correct color. As a result, the projector **10** cannot output an image normally.

[0083] As described above, the projector **10** according to the first embodiment includes a storage **121** (a first storage) that stores post-processing parameter information obtained by processing parameter information indicating parameters for the light source device **12** to appropriately emit light, a storage **150** (a second storage) that stores the processing information specific to the light source device **12**, a processor **153** that processes the post-processing parameter information stored in the storage **121** into pre-processing parameter information based on the processing information stored in the storage **150**, and a light source controller **161** that causes the light source device **12** to emit light based on the pre-processing parameter information processed by the processor **153**.

[0084] With such a configuration, in the projector **10** according to the first embodiment, when the storage **150** has not been replaced, a combination of the storage **121** in which the post-processing parameter information is stored and the storage **150** in which the processing information (license information) is stored is correct. In other words, the processor **153** is in a state in which it can correctly return the post-processing parameter information to the pre-processing parameter information. For this reason, the light source controller **161** can cause the light source device **12** to output light of an appropriate color, and the projector **10** can output an image normally. On the other hand, when the storage **150** is replaced, in the projector **10**, a combination of the storage **121** in which the post-processing parameter information is stored and the replaced storage is incorrect. In other words, the processor **153** is in a state where it cannot correctly return the post-processing parameter information to the pre-processing parameter information. For this reason, the light source controller **161** cannot cause the light source device **12** to output the light of an appropriate color, and the projector **10** cannot output an image normally.

[0085] In this manner, since the projector **10** cannot output an image normally when the storage **150** in which the license information is stored is replaced, the user cannot use the projector **10** illegally by replacing the storage **150**.

[0086] Therefore, the projector **10** according to the first embodiment makes it possible to prevent unauthorized use of the projector **10**.

1-3. Modified Example

[0087] Next, modified examples of the first embodiment will be described. Each modified example described below may be applied to the first embodiment alone, or may be applied to the first embodiment in combination with each other. Each modified example may be applied in place of the

configuration described in the first embodiment, or may be applied in addition to the configuration described in the first embodiment.

[0088] In the first embodiment described above, an example in which the projector **10** includes each of the light source device **12** and the light source control board **16** has been described, but the present invention is not limited to such an example. For example, instead of the light source device **12** and the light source control board **16**, the projector **10** may include a single device or board that has both a function of the light source device **12** and a function of the light source control board **16**.

[0089] Specifically, the light source device **12** and the light source control board **16** of the projector **10** shown in FIG. **1** may be a single device or board including the light source **120**, the storage **121**, the storage **160**, and the light source controller **161**. In this case, the light source device **12** and the light source control board **16** of the projector **10** shown in FIGS. **3**, **4**, **6**, **8**, and **9** are replaced with a single device or board. In addition, the light source device **12** in the sequence diagram shown in FIG. **2** and the light source device **12** and the light source control board **16** in the sequence diagrams shown in FIGS. **5** and **7** are replaced with a single device or board. The control board **15** communicates with the replaced single device or board. Moreover, the display **13** is irradiated with light from the light source **120** included in the replaced device or board.

[0090] In the first embodiment described above, an example in which parameter information is stored in the storage **121** of the light source device **12** has been described, but the present invention is not limited to such an example. For example, the parameter information may be stored in a storage provided in a constituent other than the light source device **12**. However, it is preferable that the parameter information be stored in a storage provided in a constituent different from a constituent provided with the storage that stores the license information.

[0091] In the case of the configuration of the first embodiment described above, the parameter information is stored in, for example, the storage **160** of the light source control board **16**. In this case, the processor **153** processes the pre-processing parameter information stored in the storage **160**, not the storage **121**, into the post-processing parameter information and overwrites it. When a light emission request is made, the processor **153** returns the post-processing parameter information stored in the storage **160** to the pre-processing parameter information. At this time, the storage **160** stores the pre-processing parameter information returned by the processor **153** without overwriting the post-processing parameter information stored in the storage **160**. When the post-processing parameter information is overwritten with pre-processing parameters, unauthorized use becomes possible, so that by not overwriting, it is possible to prevent unauthorized use. Note that a storage other than the storage **160** may be provided for the light source control board **16**, and the pre-processing parameter information returned by the processor **153** may be stored in that storage. Processing other than the processing by the processor **153** and the processing related to the storage of the pre-processing parameter information is the same as in the first embodiment described above.

[0092] Moreover, in the first embodiment described above, an example has been described in which the control board **15** of the projector **10** includes the determiner **152** and the processor **153**, but the present invention is not limited to such an example. For example, the determiner **152** and the processor **153** may be provided in a constituent other than the control board **15**. In the configuration of the first embodiment described above, the determiner **152** and the processor **153** are provided in, for example, one of the light source device **12** and the light source control board **16**. Note that the determiner **152** and the processor **153** may also be provided in the same constituent, or in different constituents.

Second Embodiment

[0093] The first embodiment of the present invention has been described above. Next, a second embodiment of the present invention will be described with reference to FIG. **10**. FIG. **10** is a diagram which shows an example of a configuration of a display device according to the second embodiment.

[0094] As shown in FIG. **10**, the display device **30** according to the second embodiment includes a first storage **310**, a second storage **320**, a processor **330**, and a light source controller **340**.

[0095] The first storage **310** stores post-processing parameter information obtained by processing parameter information indicating parameters for the light source device to emit light appropriately.

[0096] The second storage **320** stores processing information specific to the light source device.

[0097] The processor **330** processes the post-processing parameter information stored in the first storage **310** into pre-processing parameter information based on the processing information stored in the second storage **320**.

[0098] The light source controller **340** causes the light source device to emit light based on the pre-processing parameter information processed by the processor **330**.

[0099] With such a configuration, in the display device **30** according to the second embodiment, when the second storage **320** has not been replaced, a combination of the first storage **310** in which the post-processing parameter information is stored and the second storage **320** in which the processing information (license information) is stored is correct. In other words, the processor **330** is in a state in which it can correctly return the post-processing parameter information to the pre-processing parameter information. For this reason, the light source controller **340** can cause the light source device to output light of an appropriate color, and the display device **30** can output an image normally. On the other hand, when the second storage **320** is replaced, in the display device **30**, a combination of the first storage **310** in which the post-processing parameter information is stored and the replaced storage is incorrect. In other words, the processor **330** is in a state in which it cannot correctly return the post-processing parameter information to the pre-processing parameter information. For this reason, the light source controller **340** cannot cause the light source device to output the light of an appropriate color, and the display device **30** cannot output an image normally.

[0100] In this manner, since the display device **30** cannot output an image normally when the second storage **320** in which the license information is stored is replaced, the user cannot use the display device **30** illegally by replacing the second storage **320**.

[0101] Therefore, the display device **30** according to the second embodiment makes it possible to prevent unauthorized use of the display device **30**.

[0102] Each embodiment of the present invention has been described as above. Note that a part or all of the functions of the display device in each of the embodiments described above may be realized by a computer. In that case, a program for realizing this function may be recorded in a computer-readable recording medium, and the program recorded in this recording medium may be read into a computer system and executed to realize the function. Note that it is assumed that a term "computer system" herein includes an OS and hardware such as peripheral devices. In addition, a term "computer-readable recording medium" refers to a portable medium such as a flexible disk, an optical magnetic disc, an ROM, or a CD-ROM, or a storage device such as a hard disk built into a computer system. Furthermore, the term "computer-readable recording medium" may include a medium that dynamically holds a program for a short period of time, such as a communication line when a program is transmitted via a network such as the Internet or a communication line such as a telephone line, and a medium that holds a program for a certain period of time, such as a volatile memory inside a computer system that serves as a server or client in such a case. Moreover, the program described above may be a program for realizing a part of the functions described above, or may be a program that can realize the functions described above in combination with a program already recorded in the computer system, or may be a program that is realized using a programmable logic device such as a field programmable gate array (FPGA).

[0103] Although the embodiments of the present invention have been described in detail above with reference to the drawings, the specific configuration is not limited to that described above, and various design changes can be made within a range not departing from the gist of the present invention.

REFERENCE SIGNS LIST

[0104] **10** Projector
[0105] **11** Operation device
[0106] **12** Light source device
[0107] **13** Display
[0108] **14** Lens
[0109] **15** Control board
[0110] **15***a* Control board
[0111] **16** Light source control board
[0112] **20** External device
[0113] **30** Display device
[0114] **120** Light source
[0115] **121** Storage
[0116] **150** Storage
[0117] **151** Acquisitor
[0118] **152** Determiner
[0119] **153** Processor
[0120] **154** Controller
[0121] **160** Storage
[0122] **161** Light source controller
[0123] **310** First storage
[0124] **320** Second storage
[0125] **330** Processor
[0126] **340** Light source controller

1. A display device comprising:
a first storage configured to store post-processing parameter information obtained by processing parameter information indicating parameters for causing a light source device to appropriately emit light;
a second storage configured to store processing information specific to the light source device;
a processor configured to process the post-processing parameter information stored in the first storage into pre-processing parameter information based on the processing information stored in the second storage; and
a light source controller configured to cause the light source device to emit light based on the pre-processing parameter information processed by the processor.

2. The display device according to claim **1**,
wherein, when the processing information is stored in the second storage, the processor overwrites the pre-processing parameter information stored in advance in the first storage with post-processing parameter information processed based on the processing information, and
returns, when a light emission request is made from the light source device, the post-processing parameter information stored in the first storage to the pre-processing parameter information and inputs the information to the light source controller based on the processing information stored in the second storage.

3. The display device according to claim **2**,
wherein the light source controller performs control so that parameters of the light source device that emits light become parameters indicated by the pre-processing parameter information input from the processor.

4. The display device according to claim **1**,
wherein the parameter information is RGB values set so that the light source device emits light with an appropriate white balance.

5. The display device according to claim **1**,
wherein the pre-processing parameter information is the same as the parameter information.

6. The display device according to claim **1**,
wherein the post-processing parameter information is a state of the parameter information after being processed by the processing information.

7. The display device according to claim **1**, further comprising:
a first board that includes the second storage and the processor; and
a second board that includes the light source controller.

8. A display control method comprising:
a first storage process for storing post-processing parameter information obtained by processing parameter information indicating parameters for causing a light source device to appropriately emit light;
a second storage process for storing processing information specific to the light source device;
a processing process for processing the post-processing parameter information stored in the first storage into pre-processing parameter information based on the processing information stored in the second storage; and
a light source control process for causing the light source device to emit light based on the pre-processing parameter information processed by the processor.

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