[DESCRIPTION]
[Title of Invention] DISPLAY METHOD
[Technical Field]
[0001]
The present disclosure relates to a display method for displaying an image included in a video signal.
[Background Art]
[0002]
Communication techniques using visible light have been proposed. For example, as in Patent Literature 1 and 2, there are proposed techniques for superimposing communication information onto normal video using visible light, in a display device including a display, a projector, and so on.
[Citation List]
[Patent Literature]
[0003]
[PTL 1] Japanese Unexamined Patent Application Publication No. 2007-43706
[PTL 2] Japanese Unexamined Patent Application Publication No. 2009-212768
[Summary of Invention]
[Technical Problem]
[0004]
However, in the conventional display methods, there is the problem that it is difficult to reduce the probability of communication error without causing deterioration of image quality.
[0005]
In view of this, embodiments of the present disclosure seek to provide a display method, and so on, capable of (i) transmitting a visible light communication signal without causing significant deterioration of image quality of an image to be displayed, and (ii) reducing probability of communication error occurring during the transmission.
[Solution to Problem]
[0006]
~~A display method according to an aspect of the present disclosure is a display method for representing, when an image~~

~~included in a video signal is displayed on a per frame basis, a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed, the display method including: specifying, as a specified light emission period, a light emission period in which light emission is performed for greater than or equal to a time required for transmitting a signal unit included in a visible light communication signal, out of one or more light emission periods in which light emission is performed for displaying the image included in the video signal; and transmitting the signal unit included in the visible light communication signal by luminance changing in the specified light emission period.~~

According to a first aspect of the present disclosure, there is provided a display method, comprising: displaying an image included in a video signal on a per frame basis; representing a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed; specifying, as a specified light emission period, a light emission period in which light emission is performed for greater than or equal to a time required for transmitting a separate signal that conveys communication information included in a visible light communication signal, out of one or more light emission periods in which light emission is performed for displaying the image included in the video signal, the separate signal, which conveys communication information, being transmitted by repeatedly changing in luminance from a high luminance value to a low luminance value, and from the low luminance value to the high luminance value, during the time required for transmitting; and transmitting the separate signal , which conveys communication information, included in the visible light communication signal by superimposing the separate signal onto a portion of the video signal corresponding to the specified light emission period of the video signal and repeatedly changing in luminance from the high luminance value to the low luminance value, and from the low luminance value to the high luminance value, during the specified light emission period, wherein, in the transmitting, in a case where the specified light emission period is greater than or equal to a time required for transmitting a plurality of separate signals including the separate signal, the plurality of separate signals of the

visible light communication signal are transmitted by luminance changing in the specified light emission period.

[0006a]

~~According to another aspect of the present invention, there is provided a display device which represents, when an image included in a video signal is displayed on a per frame basis, a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed, the display device comprising: a light emission period specifying unit configured to specify, as a specified light emission period, a light emission period in which light emission is performed for greater than or equal to a time required for transmitting a signal unit included in a visible light communication signal, out of one or more light emission periods in which light emission is performed for displaying the image included in the video signal; and a transmitting unit configured to transmit the signal unit included in the visible light communication signal by luminance changing in the specified light emission period.~~

According to a second aspect of the present disclosure, there is provided a display device, comprising: a display that represents, when an image included in a video signal on a per frame basis, a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed; a light emission period specifier that specifies, as a specified light emission period, a light emission period in which light emission is performed for greater than or equal to a time required for transmitting a separate signal that conveys communication information included in a visible light communication signal, out of one or more light emission periods in which light emission is performed for displaying the image included in the video signal, the separate signal, which conveys communication information, being transmitted by repeatedly changing in luminance from a high luminance value to a low luminance value, and from the low luminance value to the high luminance value, during the time required for transmitting; and a transmitter that transmits the separate signal, which conveys communication information, included in the visible light communication signal by superimposing the separate signal onto a

portion of the video signal corresponding to the specified light emission period of the video signal and repeatedly changing in luminance from the high luminance value to the low luminance value, and from the low luminance value to the high luminance value, during the specified light emission period, wherein, in the transmitting, in a case where the specified light emission period is greater than or equal to a time required for transmitting a plurality of separate signals including the separate signal, the plurality of separate signals of the visible light communication signal are transmitted by luminance changing in the specified light emission period.

[Advantageous Effects of Invention]

[0007]

According to embodiments of the present disclosure, the probability of communication error in visible light communication can be reduced without causing significant deterioration of image quality.

[Brief Description of Drawings]

[0008]

[FIG. 1] FIG. 1 is a schematic diagram illustrating a visible lightcommunication system according to Embodiment 1.

[FIG. 2] FIG. 2 is a schematic diagram illustrating a display surface according to Embodiment 1.

[FIG. 3] FIG. 3 is a block diagram illustrating an outline configuration of a display device according to Embodiment 1.

[FIG. 4] FIG. 4 is a schematic diagram illustrating an example of a state in which a visible light communication signal is superimposed onto a backlight signal for video display, according to Embodiment 1.

[FIG. 5] FIG. 5 is a schematic diagram illustrating an example of backlight control according to Embodiment 1.

[FIG. 6A] FIG. 6A is a schematic diagram illustrating an example of a visible light communication signal when duty ratio is changed, according to Embodiment 1.

[FIG. 6B] FIG. 6B is a schematic diagram illustrating an example

~~[CLAIMS]~~CLAIMS

~~[Claim 1]~~

1. A display method, ~~for representing, when an image included in a video signal is displayed on a per frame basis, a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed, the display method~~ comprising:

displaying an image included in a video signal on a per frame basis;

representing a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed;

specifying, as a specified light emission period, a light emission period in which light emission is performed for greater than or equal to a time required for transmitting a separate signal ~~unit~~ that conveys communication information included in a visible light communication signal, out of one or more light emission periods in which light emission is performed for displaying the image included in the video signal, the separate signal, which conveys communication information, being transmitted by repeatedly changing in luminance from a high luminance value to a low luminance value, and from the low luminance value to the high luminance value, during the time required for transmitting; and

transmitting the separate signal ~~unit~~, which conveys communication information, included in the visible light communication signal by ~~luminance changing in~~ superimposing the separate signal onto a portion of the video signal corresponding to the specified light emission period of the video signal and repeatedly changing in luminance from the high luminance value to the low luminance value, and from the low luminance value to the high luminance value, during the specified light emission period,

wherein, in the transmitting, in a case where the specified light emission period is greater than or equal to a time required for transmitting a plurality of separate signals including the separate signal, the plurality of separate signals of the visible light communication signal are transmitted by luminance changing in the specified light emission period.

~~[Claim 2]~~

~~The display method according to Claim 1,~~

~~wherein, in the transmitting, in the case where the specified light emission period is greater than or equal to a time required for transmitting a plurality of signal units including the signal unit, the signal units of the visible light communication signal are transmitted by luminance changing in the specified light emission period.~~

~~[Claim 3]~~

2. The display method according to ~~one of Claims 1 and 2~~ Claim 1, further comprising:

calculating a whole number in a quotient obtained by dividing each of the one or more light emission periods by the time required for transmitting the separate signal ~~unit~~,

wherein, in the specifying, a light emission period for which the whole number portion of the quotient is 1 or more is specified as the specified light emission period, and

in the transmitting, ~~signal units~~ separate signals equivalent in number to the whole number ~~is~~ are transmitted in the specified light emission period.

~~[Claim 4]~~

3. The display method according to ~~any one of Claims 1 to 3~~ Claim 1 or 2,

wherein, in ~~the~~ a case where the luminance of the image is controlled through each of colors for representing the image, the transmitting for a first color among the colors and the transmitting for a second color among the colors are performed in parallel.

~~[Claim 5]~~

4. The display method according to any one of Claims 1 to 3,

wherein, in ~~the~~ a case where the luminance of the image is controlled for each of colors for representing the image:

in the specifying, a period which is greater than or equal to the time required for transmitting the separate signal ~~unit~~ is specified as the specified light emission period, the period including a light emission period for a first color among the colors and a light emission period for a second color among the colors consecutive to the light emission period for the first color; and

in the transmitting, part of the separate signal ~~unit~~ is transmitted by

luminance changing in the light emission period for the first color, and the remaining part of the separate signal ~~unit~~ is transmitted by luminance changing in the light emission period for the second color.

~~[Claim 6]~~

5. The display method according to Claim ~~5~~4, further comprising

changing a light emission timing for the first color or the second color to make the light emission period for the first color and the light emission period for the second color consecutive, when the light emission period for the first color and the light emission period for the second color are not consecutive.

~~[Claim 7]~~

6. The display method according to any one of Claims 1 to 3, further comprising:

matching, in ~~the~~ a case the luminance is controlled for each of pixels for representing the image, a start point of a light emission period for a first pixel among the pixels and a start point of a light emission period for a second pixel adjacent to the first pixel among the pixels, when the start points do not match,

wherein, in the specifying, a period in which the light emission period for the first pixel and the light emission period for the second pixel overlap is specified as the specified light emission period, and

in the transmitting, the separate signal ~~unit~~ is transmitted by luminance changing by the first pixel and the second pixel in the specified light emission period.

~~[Claim 8]~~

7. The display method according to any one of Claims 1 to ~~7~~6,

wherein, when the frame consists of sub-frames,

in the specifying, a period including two consecutive sub-frames in which light emission is performed is created by moving at least one of two non-consecutive sub-frames in which light emission is performed for displaying the image included in the video signal, and the period is specified as the specified light emission period.

~~[Claim 9]~~

8. The display method according to any one of Claims 1 to ~~8~~7, further comprising

in ~~the~~ a case where the frame consists of sub-frames, and each of the one or more light emission periods is any one sub-frame among the sub-frames,

causing light emission in a sub-frame in which light emission is not performed for displaying the image included in the video signal, and which has a period corresponding to a duty ratio of the separate signal ~~unit~~.

~~[Claim 10]~~

9. The display method according to any one of Claims 1 to ~~8~~7, further comprising

lengthening the specified light emission period for as long as a period in which light emission is suppressed for transmitting the separate signal ~~unit~~.

~~[Claim 11]~~

10. A display device, ~~which represents, when an image included in a video signal is displayed on a per frame basis, a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed, the display device~~ comprising:

a display that represents, when an image included in a video signal on a per frame basis, a tone level of luminance of the image by controlling a light emission period in a frame, the light emission period being a period in which light emission is performed;

a light emission period ~~specifying unit configured to specify~~ specifier that specifies, as a specified light emission period, a light emission period in which light emission is performed for greater than or equal to a time required for transmitting a separate signal ~~unit~~ that conveys communication information included in a visible light communication signal, out of one or more light emission periods in which light emission is performed for displaying the image included in the video signal, the separate signal, which conveys communication information, being transmitted by repeatedly changing in luminance from a high luminance value to a low luminance

value, and from the low luminance value to the high luminance value, during the time required for transmitting; and

a ~~transmitting unit configured to~~ transmitter that transmits the separate signal ~~unit~~ , which conveys communication information, included in the visible light communication signal by ~~luminance changing in~~ superimposing the separate signal onto a portion of the video signal corresponding to the specified light emission period of the video signal and repeatedly changing in luminance from the high luminance value to the low luminance value, and from the low luminance value to the high luminance value, during the specified light emission period,

wherein, in the transmitting, in a case where the specified light emission period is greater than or equal to a time required for transmitting a plurality of separate signals including the separate signal, the plurality of separate signals of the visible light communication signal are transmitted by luminance changing in the specified light emission period.