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[Summary]

[Technical Problems]

[0005]

However, in the case where three-dimensional information of an image pickup object is transmitted as three-dimensional data, a processing unit of a high function that processes three-dimensional data is required on the reception side.

[0006]

Meanwhile, in the case where three-dimensional information of an image pickup object is transmitted in the form of two-dimensional image data and depth image data obtained by a plurality of cameras, although processing by the reception side is easier, the viewpoints of the plurality of cameras are not necessarily viewpoints suitable for a predetermined display image generation method, and excess or deficiency of viewpoints occurs on the reception side.

[0007]

Embodiments of the present invention make it possible to acquire two-dimensional image data and depth image data of viewpoints corresponding to a predetermined display image generation method without depending upon viewpoints upon image pickup.

[Solution to Problems]

[0008]

According to a first aspect of the present invention, there is provided an encoding apparatus, including: a two-

dimensional data generation unit that generates, from three-dimensional data of an image pickup object, two-dimensional image data of a plurality of first viewpoints corresponding to a given display image generation method and depth image data indicative of a position of each of pixels in a depthwise direction of the image pickup object with respect to a second viewpoint; an encoding unit that encodes the two-dimensional image data of the plurality of first viewpoints and the depth image data generated by the two-dimensional data generation unit; and a transmission unit that transmits the two-dimensional image data of the plurality of first viewpoints and the depth image data encoded by the encoding unit.

[0009]

According to a second aspect of the present invention, there is provided an encoding method by an encoding apparatus, the encoding method including: a two-dimensional data generation step of generating, from three-dimensional data of an image pickup object, two-dimensional image data of a plurality of first viewpoints corresponding to a given display image generation method and depth image data indicative of a position of each of pixels in a depthwise direction of the image pickup object with respect to a second viewpoint; an encoding step of encoding the two-dimensional image data of the plurality of first viewpoints and the depth image data generated by the process of the two-dimensional data generation step; and a transmission step of transmitting the two-dimensional image data of the plurality of first viewpoints and the depth image data encoded by the process of the encoding step.

[0010]

In the above aspects of the present invention, from three-dimensional data of an image pickup object generated from two-dimensional image data of a plurality of first viewpoints, two-dimensional image data of a plurality of second viewpoints corresponding to a given display image generation method and depth image data indicative of a position of each of pixels in a depthwise direction of the image pickup object with respect to a third viewpoint are generated. Then, the two-dimensional image data of the plurality of second viewpoints and the depth image data that are generated are encoded, and the two-dimensional image data of the plurality of second viewpoints and the depth image data that are encoded are transmitted.

[0011]

According to a third aspect of the present invention, there is provided a decoding apparatus, including: a reception unit configured to receive encoded data of two-dimensional image data of a plurality of first viewpoints and encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint, generated from three-dimensional data of an image pickup object; a decoding unit configured to decode the encoded data of two-dimensional image data of a plurality of first viewpoints and the encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint; a three-dimensional data generation unit configured to generate three-dimensional data of the image pickup object using the two-dimensional image

data of the plurality of first viewpoints and the depth image data obtained as a result of decoding by the decoding unit; and a two-dimensional data generation unit configured to generate two-dimensional image data as display image data by the given display image generation method on the basis of the three-dimensional data generated by the three-dimensional data generation unit.

[0012]

According to a fourth aspect of the present invention, there is provided a decoding method by a decoding apparatus, the decoding method including: a receiving step of receiving encoded data of two-dimensional image data of a plurality of first viewpoints and encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint, generated from three-dimensional data of an image pickup object; a decoding step of decoding the encoded data of two-dimensional image data of a plurality of first viewpoints and the encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint; a three-dimensional data generation step of generating three-dimensional data of the image pickup object using the two-dimensional image data of the plurality of first viewpoints and the depth image data obtained as a result of decoding by the process of the decoding step; and a two-dimensional data generation step of generating two-dimensional image data as display image data by the given display image generation method on the basis of the three-dimensional data generated by the process of the three-dimensional data generation step.

[0013]

In the above aspects of the present invention, encoded data of two-dimensional image data of a plurality of first viewpoints corresponding to a given display image generation method and encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint are decoded. Then, three-dimensional data of the image pickup object is generated using the two-dimensional image data of the plurality of first viewpoints and the depth image data obtained as a result of decoding, and two-dimensional image data is generated as display image data by the given display image generation method on the basis of the generated three-dimensional data.

[0014]

It is to be noted that the encoding apparatus and the decoding apparatus of the above aspects can be implemented by causing a program to be executed by a computer.

[0015]

Further, in order to implement the encoding apparatus and the decoding apparatus of the above aspects, the program to be executed by a computer can be provided by transmitting the same through a transmission medium or by recording the same on a recording medium.

[Advantageous Effects of Invention]

[0016]

According to the above aspect of the present invention, encoding can be performed. Further, according to the above aspect of the present invention, two-dimensional image data of

a viewpoint corresponding to a given display image generation method and depth image data can be encoded such that they can be acquired by a decoding apparatus without depending upon a viewpoint upon image pickup.

[0017]

According to the above aspect of the present invention, decoding can be performed. Further, according to the above aspect of the present invention, two-dimensional image data of a viewpoint corresponding to a given display image generation method and depth image data can be acquired without depending upon a viewpoint upon image pickup.

[0018]

It is to be noted that the effects described here are not necessarily restrictive and any one of the effects described in the present invention may be applied.

[Brief Description of Drawings]

[0019]

[FIG. 1]

FIG. 1 is a block diagram depicting an example of a configuration of a first embodiment of a transmission system to which the present disclosure is applied.

[FIG. 2]

FIG. 2 is a block diagram depicting an example of a configuration of a conversion unit of FIG. 1.

[FIG. 3]

FIG. 3 is a view depicting an example of a plurality of viewpoints corresponding to a predetermined

CLAIMS

1. An encoding apparatus, comprising:

a two-dimensional data generation unit that generates, from three-dimensional data of an image pickup object, two-dimensional image data of a plurality of first viewpoints corresponding to a given display image generation method and depth image data indicative of a position of each of pixels in a depthwise direction of the image pickup object with respect to a second viewpoint;

an encoding unit that encodes the two-dimensional image data of the plurality of first viewpoints and the depth image data generated by the two-dimensional data generation unit; and

a transmission unit that transmits the two-dimensional image data of the plurality of first viewpoints and the depth image data encoded by the encoding unit.

2. The encoding apparatus according to claim 1, wherein

the plurality of first viewpoints exist at equal distances on a same circle.

3. The encoding apparatus according to claim 1, wherein

at least two viewpoints from among the plurality of first viewpoints are lined up in a substantially horizontal direction.

4. The encoding apparatus according to claim 3, wherein

the transmission unit transmits information that specifies two viewpoints lined up in a horizontal direction from among the plurality of first viewpoints.

5. The encoding apparatus according to claim 1, wherein

the transmission unit transmits the three-dimensional data in an occlusion region from within the two-dimensional image data of the plurality of first viewpoints.

6. The encoding apparatus according to claim 1, wherein

the two-dimensional data generation unit generates the two-dimensional image data of the plurality of first viewpoints from the three-dimensional data on the basis of a camera parameter of the plurality of first viewpoints, and generates the depth image data on the basis of a camera parameter of the second viewpoint; and

the transmission unit transmits the camera parameters of the plurality of first viewpoints and of the second viewpoint.

7. The encoding apparatus according to claim 1, wherein

the number of the given display image generation methods is a plural number.

8. The encoding apparatus according to claim 1, wherein

the plurality of first viewpoints and the second viewpoint are same.

9. An encoding method by an encoding apparatus, the encoding method comprising:

a two-dimensional data generation step of generating, from three-dimensional data of an image pickup object, two-dimensional image data of a plurality of first viewpoints corresponding to a given display image generation method and depth image data indicative of a position of each of pixels in a depthwise direction of the image pickup object with respect to a second viewpoint;

an encoding step of encoding the two-dimensional image data of the plurality of first viewpoints and the depth image data generated by the process of the two-dimensional data generation step; and

a transmission step of transmitting the two-dimensional image data of the plurality of first viewpoints and the depth image data encoded by the process of the encoding step.

10. A decoding apparatus, comprising:

a reception unit configured to receive encoded data of two-dimensional image data of a plurality of first viewpoints and encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint, generated from three-dimensional data of an image pickup object;

a decoding unit configured to decode the encoded data of two-dimensional image data of a plurality of first viewpoints and the encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint;

a three-dimensional data generation unit configured to generate three-dimensional data of the image pickup object using the two-dimensional image data of the plurality of first viewpoints and the depth image data obtained as a result of decoding by the decoding unit; and

a two-dimensional data generation unit configured to generate two-dimensional image data as display image data by the given display image generation method on the basis of the three-dimensional data generated by the three-dimensional data generation unit.

11. The decoding apparatus according to claim 10, wherein

the plurality of first viewpoints exist at equal distances on a same circle.

12. The decoding apparatus according to claim 10, wherein

at least two viewpoints from among the plurality of first viewpoints are lined up in a substantially horizontal direction.

13. The decoding apparatus according to claim 12, further comprising:

a reception unit that receives information that specifies two viewpoints lined up in a horizontal direction from among the plurality of first viewpoints.

14. The decoding apparatus according to claim 10, wherein the two-dimensional image data of the plurality of first viewpoints and the depth image data are generated from three-dimensional data of the image pickup object generated from two-dimensional image data of a plurality of third viewpoints.

15. The decoding apparatus according to claim 14, wherein the three-dimensional data generation unit generates three-dimensional data of the image pickup object using the two-dimensional image data of the plurality of first viewpoints, the depth image data and three-dimensional data of an occlusion region from within the two-dimensional image data of the plurality of first viewpoints.

16. The decoding apparatus according to claim 10, wherein the three-dimensional data generation unit generates three-dimensional data of the image pickup object on the basis of camera parameters of the plurality of first viewpoints and the second viewpoint.

17. The decoding apparatus according to claim 10, wherein the number of the given display image generation methods is a plural number.

18. The decoding apparatus according to claim 10, wherein the plurality of first viewpoints and the second viewpoint are same.

19. A decoding method by a decoding apparatus, the decoding method comprising:

a receiving step of receiving encoded data of two-dimensional image data of a plurality of first viewpoints and encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint, generated from three-dimensional data of an image pickup object;

a decoding step of decoding the encoded data of two-dimensional image data of a plurality of first viewpoints and the encoded data of depth image data indicative of a position of each of pixels in a depthwise direction of an image pickup object with respect to a second viewpoint;

a three-dimensional data generation step of generating three-dimensional data of the image pickup object using the two-dimensional image data of the plurality of first viewpoints and the depth image data obtained as a result of decoding by the process of the decoding step; and

a two-dimensional data generation step of generating two-dimensional image data as display image data by the given display image generation method on the basis of the three-dimensional data generated by the process of the three-dimensional data generation step.