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TITLE OF THE INVENTION

INFORMATION TRANSMISSION METHOD AND APPARATUS

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BACKGROUND OF THE INVENTIONField of the Invention

This invention relates to an information transmission method and apparatus, and more particularly, to an information transmission method and apparatus in which the transmission speed of information can be switched.

Description of the Related Art

FIG. 4 is a diagram schematically illustrating transmitted information whose amount per unit time T (seconds) (the data rate) equals N (bits).

In FIG. 4, a hatched portion 11 represents check codes for error correction. FIG. 4 illustrates a case in which the redundancy for the total amount of information N (bits) including an information-code portion 12 equals m , and the following amount of check codes per unit time T (seconds) equals mN (bits).

A case will now be considered in which the amount of information to be transmitted per unit time T (seconds) (transmission speed) is changed to kN (bits). FIG. 5 is a

diagram schematically illustrating information to be transmitted per unit time in such a case.

5 If it is assumed that the redundancy m is not changed for the purpose of not changing the error correction capability, the amount of check codes per unit time T (seconds) becomes kmN (bits), as shown in FIG. 5.

10 In the above-described transmission format, therefore, the amount of check codes per unit time T (seconds) following the information codes is changed if the transmission speed is changed. Hence, it is necessary to change the form of the error-correcting code so as to be suitable for the amount of check codes.

15 This results in providing different forms of error-correcting codes for different transmission speeds, causing difficulty in circuit design and an increase of the size of the hardware.

20 The above-described approach also has the problem that even though the redundancy is not changed, the correction capability may change when different error-correcting codes are used in accordance with the form of the error-correcting code.

SUMMARY OF THE INVENTION

25 The present invention has been made in consideration of

the above-described problems in the prior art.

It is an object of the present invention to provide an information transmission method and an information transmission apparatus in which common hardware can be used for
5 transmission at different speeds while always maintaining a constant error correcting capability.

This object is accomplished, according to one aspect of the present invention, by an information transmission method comprising the steps of transmitting information in units of
10 a block including information codes and error-correcting check codes at one of a plurality of transmission speeds, and switching from one transmission speed to another by changing the number of blocks to be transmitted per unit time without changing the amount of information of the in-
15 formation codes and the amount of information of the error-correcting check codes within each block.

According to another aspect, the present invention relates to an information transmission apparatus comprising means for establishing a first transmission mode for trans-
20 mitting a first predetermined number of blocks per unit time, each block including a predetermined amount of information codes and a predetermined amount of error-correcting check codes, and means for establishing a second transmission mode for transmitting a second predetermined number,
25 different from the first predetermined number, per unit time

of blocks including the predetermined amount of information codes and the predetermined amount of error-correcting check codes.

5 The foregoing and other objects, advantages and features of the present invention will become more apparent from the following detailed description of the preferred embodiment taken in conjunction with the accompanying drawings.

10 BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing the schematic configuration of an image transmission apparatus according to an embodiment of the present invention;

15 FIG. 2 is a diagram schematically illustrating an information-code string to be transmitted per unit time in a first mode in the image transmission apparatus shown in FIG.1;

20 FIG. 3 is a diagram schematically illustrating an information-code string to be transmitted per unit time in a second mode in the image transmission apparatus shown in FIG.1;

FIG. 4 is a diagram schematically illustrating conventional information to be transmitted per unit time; and

25 FIG. 5 is schematically illustrating conventional in-

formation to be transmitted per unit time at a transmission speed different from that shown in FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

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A preferred embodiment of the present invention will now be explained in detail with reference to the drawings.

FIG. 1 is a block diagram showing the schematic configuration of an image transmission apparatus to which the present invention is applied.

In FIG. 1, there is shown an input terminal 101 for image signals. An image signal input from the input terminal 101 is supplied to a quantization circuit 102.

The quantization circuit 102 performs quantization in accordance with a quantization coefficient determined by transmission-speed information input from a transmission clock signal generation circuit 105 and information relating to the amount of encoded data input from a variable-length encoding circuit 103, so that the amount of data which are finally output is constant in units of each picture frame.

The variable-length encoding circuit 103 performs variable-length encoding of information output from the quantization circuit 102 and supplies the encoded information to a data adding or synthesis circuit 106, and also outputs the information to the quantization circuit 102 for

determining the quantization coefficient in accordance with the amount of data of the encoded information.

5 The data synthesis circuit 106 divides the image information subjected to variable-length encoding into respective blocks for every predetermined amount of codes. An error-correcting code generation circuit 104 generates check codes and adds the generated check codes to each of the above-described blocks. Each block to which the check codes are added will be hereinafter termed a small block.

10 The transmission clock signal generation circuit 105 supplies the data synthesis circuit 106 with a transmission clock signal whose frequency is switched in accordance with the transmission speed.

15 The data synthesis circuit 106 changes the number of small blocks to be transmitted per unit time so that the desired transmission speed can be obtained in accordance with the transmission clock signal. It is thereby possible to supply a code string at the desired transmission speed to an output terminal 107.

20 FIG. 2 is a diagram schematically illustrating an information-code string to be transmitted in a unit time T (seconds) in a first mode in the image transmission apparatus shown in FIG. 1.

25 In FIG. 2, reference numeral 1 indicates the total amount N (bits) of codes to be transmitted in the unit time

T (seconds). The encoded image information is divided into n portions ($2a - 2n$ shown in FIG. 2), one for each small block containing the predetermined amount of information codes. The total amount of codes in each of the divided small blocks equals N/n (bits).

Check codes $3a - 3n$ for error correction whose amount is defined by a predetermined redundancy m are added to the respective small blocks. The amount of check codes in each small block equals mN/n (bits).

FIG. 3 is a diagram schematically illustrating an information-code string to be transmitted per unit time T (seconds) in a second mode in the image transmission apparatus shown in FIG. 1, when the amount of codes to be transmitted per unit time T (seconds) is assumed to be kN (bits).

In FIG. 3, reference numeral 4 indicates the total amount kN (bits) of codes to be transmitted in unit time T (seconds). The encoded image information is divided into x ($= nk$) portions ($2a - 2x$ shown in FIG. 3), one for each small block containing the predetermined amount of information code. Also, the amount of check codes $3a - 3n$ in each small block is mN/n (bits).

Thus, the amount of image information and the amount of information of check codes in each of the x divided small blocks are the same as in the first mode. The total amount

of codes in each small block therefore equals N/n (bits).

The desired transmission speed can be obtained by arranging that the value nk be an integer. Accordingly, by making the value n as large as possible, the degree of freedom increases for the value k . Consequently, the value k is not necessarily an integer.

That is, if the number of different transmission speeds which can be used is small, the amount of codes may be determined so that the total amount of codes to be transmitted becomes an integer multiple of the amount of codes in each block.

As is apparent from the foregoing explanation, in the information transmission method and the information transmission apparatus of the present invention, while transmission at different speeds can be performed, the amount of information of information codes and the amount of information of check codes for error correction within a block do not change. Hence, the error correction capability does not have to change in any way even if the transmission speed is changed, and thus the problem in the prior art that the error correction capability changes when the transmission speed is changed is overcome. In addition, the size of the hardware does not increase since exactly the same error processing can be performed for different transmission speeds.

The present invention can be executed in various other forms without departing from the true spirit and scope of the invention.

5 For example, although in FIGS. 2 and 3 illustrating the above-described embodiment, encoded image information and check codes for error correction are alternately arranged, the object of the present invention may, of course, be achieved no matter how they are arranged in the information transmission string, provided that all information in the
10 information transmission strings 1 and 4 in FIGS. 2 and 3, respectively, can be transmitted in a unit time T (seconds).

In other words, the foregoing description of the embodiment has been given for illustrative purposes only and not to be construed as imposing any limitation in every
15 aspect.

The scope of the invention is, therefore, to be determined by reference to the following claims and is not limited by the text of the specification, and alterations may be made within the true spirit and scope of the inven-
20 tion.

WHAT IS CLAIMED IS:

1. An information transmission method in which transmission speed of information is switched, said method comprising the steps of:

transmitting information in units of a block including information codes and error-correcting check codes at one of a plurality of transmission speeds; and

switching from one transmission speed to another by changing a number of blocks to be transmitted per unit time without changing an amount of information of the information codes and the amount of information of the error-correcting check codes within each block.

2. A method according to Claim 1, wherein each information code comprises a code obtained by performing variable-length encoding of an image signal for every predetermined number of picture elements.

3. A method according to Claim 1, wherein the number of blocks is changed so that a ratio of the number of blocks before the change to the number of blocks after the change is equal to a ratio of a total amount of codes to be transmitted per unit time before the change to a total amount of codes to be transmitted per unit time after the change.



4. An information transmission apparatus, comprising:

means for establishing a first transmission mode for transmitting a first predetermined number of blocks per unit time, each block including a predetermined amount of information codes and a predetermined amount of error-correcting check codes; and

means for establishing a second transmission mode for transmitting a second predetermined number, different from said first predetermined number, per unit time of blocks including said predetermined amount of information codes and said predetermined amount of error-correcting check codes.

5. An apparatus according to Claim 4, wherein each information code comprises a code obtained by performing variable-length encoding of an image signal for every predetermined number of picture elements.

6. An apparatus according to Claim 4, wherein said apparatus is controlled so that a ratio of said first predetermined number to said second predetermined number equals a ratio of a total amount of codes to be transmitted per unit time in said first mode to a total amount of codes to be transmitted per unit time in said second mode.



7. An image transmission apparatus, comprising:

variable-length encoding means for forming information codes by performing variable-length encoding of an image signal;

dividing means for dividing the information codes into blocks for every predetermined amount of codes;

error-correcting encoding means for generating check codes for forming error-correcting codes for respective information codes divided by said dividing means;

synthesis means for synthesizing the divided information codes and the check codes and outputting synthesized blocks of data; and

control means for controlling a number of said blocks of block data output per unit time.

8. An apparatus according to Claim 7, wherein said variable-length encoding means includes quantization means for quantizing the image signal.

9. An apparatus according to Claim 8, wherein a quantization coefficient of said quantization means is determined by said variable-length encoding means and said control means.



10. An information transmission method comprising transmitting information in units of a block including information codes and error-correcting check codes, and switching the transmission speed by changing the number of blocks to be transmitted per unit time without changing the amount of information of the information codes and the amount of information of the error-correcting check codes within each block.

11. An information transmission apparatus, comprising means for transmitting information in units of a block including information codes and error-correcting check codes, and means for switching the transmission speed by changing the number of blocks to be transmitted per unit time without changing the amount of information of the information codes and the amount of information of the error-correcting check codes within each block.

