

TITLE OF THE INVENTION

COLOR IMAGE TRANSMITTING METHOD

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a color image transmitting method e.g. in a color facsimile machine for transmitting color image data by utilizing a public line or the like.

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2. Description of the Related Arts

Hitherto, there has been a method of transmitting a color original document through a digital public line or ISDN arranged in such a manner that the data about the whole portion of the color original document is processed as color image data and the data about the whole portion is thereby transmitted as it is. However, when a full image data of a A4 (219.46mm x 297mm) sized original document is transmitted through a line having 64Kbps in line speed in the form of, for example, an RGB color image, it takes 739.9 seconds (12 minutes and 19.09 seconds) in a case of a binary data image of a line density of 400 dpi. What is even worse, in a case of a multivalued data image, it takes 5919.3 seconds (98 minutes and 39.03 seconds).

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Therefore, a variety of color image data compression methods have been disclosed in which a color image is compressed by a variety of methods so as to be transmitted. As the color image compression methods of the type  
5 described above, there have been a vector quantizing method in which the image is replaced by sets of predetermined patterns and an ADCT (Adaptive Discrete Cosine Transform) which is an orthogonally conversion encoding method.

However, the above-described method in which the  
10 whole of the original document is transmitted as it is encounters a problem in terms of a practical use since an excessively long time is taken except for a case in which accurate image data is desired to be received by the receipt side so as to have it stored in a storage.

15 On the other hand, the image transmission method in which an image compression is performed exhibits an advantage obtainable in that the quantity of data can be significantly reduced and the time necessary to transmit the image can be shortened if the image is compressed in  
20 accordance with a proper algorithm. However, partial missing of image information cannot be prevented by a properly selected compressing technology when the compression ratio is raised. Furthermore, another problem arises in that image data about an image which greatly  
25 changes, a smooth image, an image containing human's skin

and an image including characters cannot efficiently and satisfactorily be compressed.

SUMMARY OF THE INVENTION

5       According to the invention, there is provided a method of transmitting as set out in claim 1 and apparatus for transmitting as set out in claim 9. The remaining claims set out optional features.

10       The invention involves generating first compressed data for the region containing both said areas but in which one of the areas is replaced by a blank;

          generating second compressed data for the area which is replaced by a blank in the first compressed data; and

15       transmitting the first and second compressed data together with positional data relating to the position of at least one of the said areas. In the illustrated embodiment, the positional data is transmitted first. Alternatively, the positional data may separate the first and second compressed data.

Embodiments of the invention, given by way of example, will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

5        Fig. 1 is a perspective view which illustrates the structure of an apparatus according to an embodiment of the present invention;

Fig. 2 is a perspective view which illustrates the shape of the apparatus shown in Fig. 1;

10       Fig. 3 is a flow chart which illustrates the operation of the apparatus according to this embodiment;

Figs. 4A and 4B respectively illustrate the program of a BOX type window and that of a circular window;

Fig. 5 illustrates other examples of the window;

15       Fig. 6 illustrates the relationship between the position of the original document at which it is read and data;

Fig. 7 is a timing chart for reading a color original document to be read by the apparatus shown in Fig. 1;

20       Fig. 8 is a timing chart which illustrates the operation of the apparatus shown in Fig. 1;

Fig. 9 illustrates the sequential order of image data to be transmitted by the apparatus shown in Fig. 1;

25       Figs. 10A to 10C respectively illustrate the operation according to the embodiment of the present invention;

Figs. 11A to 11D respectively illustrate the operation according to the embodiment of the present invention; and

Figs. 12A to 12B respectively illustrate an area of compressing binary image data and an area of compressing  
5 multi level color image data.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

<The structure of an apparatus according to this embodiment>

Fig. 1 is a structural view which illustrates an  
10 apparatus embodying to the present invention.

Referring to Fig. 1, reference numeral 130 represents a region indicating circuit for a mouse, a digitizer or a point pen. A CPU 107 converts the region indicated by the region indicating circuit 130 in vector data such as Post  
15 Script. Then, multivalued image data is read by an RGB scanner portion 101, the image, which has been thus read, being divided into data to be compressed in multi level and data to be compressed in binary in response to a color enable signal generated by a color enable generator 103.

20 That is, the multi level color data item is, by latches 109, 111 and 113, latched for each of colors red, green and blue before it is temporarily stored in a color image memory 117. Then, it is subjected to a multi level color image compression process in an image compression  
25 circuit 125.

On the other hand, the data item to be compressed in binary is latched by a latch 115. Then, when the subject region is the multi level color data region, "0" is inserted in place of the latched data item by a blank data insertion circuit 116 and a selector 119 which is arranged to operate in response to a color enable signal. Then, the data item to be compressed in binary, including the inserted blank data<sup>is</sup>, is binarized, and is stored as binary data in a binary image memory 123. The value of the binary image stored in the binary image memory 123 is encoded in accordance with a binary coding method such as MH, MR and MMR, or color binary coding method such as Q coder by a binary encoding circuit 127.

The above-described two data items, which have been respectively compressed and encoded by the color image compression circuit 125 and the binary encoding circuit 127, are transmitted by a communication control circuit 129.

Then, the outline of a color facsimile machine according to this embodiment will be described with reference to Fig. 2.

The color facsimile machine according to this embodiment comprises a color data read port A, a color print output portion B and a region indicating portion C. A color original document sheet is, similarly to a black and white facsimile machine, supplied through the read port

A. The original document sheet is conveyed to a read portion serving as the region indicating portion C.

According to this embodiment, the read portion is arranged in such a manner that the color original document sheet is,

5 by a user, placed below a touch panel constituting the region indicating portion C and a frame is indicated by using a pen or the like so that the frame can be indicated by a user. According to this embodiment, a frame in the original document sheet, which is being observed through  
10 the touch panel, is indicated. However, another method may be employed in which the color facsimile machine is arranged to comprise a memory and a display so that the frame is indicated on the display. Furthermore, in the case where the original document sheet is a document in  
15 which the picture portions and character portions are clearly divided from one another, the color image portions suitable for multi level compression and the character portions suitable for binary compression can automatically be divided by utilizing a so-called "image region  
20 separation" method. For example, a method can be employed in which the character portions and the picture portions can automatically be discriminated by utilizing a fact that the character portion shows a large change in the image data and the picture portion shows a reduced change. As

described above, the image region and the character region are separated from each other.

<Operation procedure of the apparatus according to this embodiment>

5       The operation procedure of the apparatus according to this embodiment will be described with reference to a flow chart of a color facsimile data processing procedure shown in Fig. 3.

10       According to this embodiment, the size of the paper sheet is indicated in step S01. Then, in step S02, the picture and the indicated portions in the color original document are indicated. In step S03, window vector information such as Post Script in the indicated frame is processed. Then, in step S04, it is determined whether or  
15       not the data item thus supplied contains only the vector information. If it has been determined that the supplied data item does not contain only the vector information, the subject operation is the operation in which image information is transmitted. Therefore, the flow branches  
20       from step S04 to S05.

      In step S05, a sensor is moved to a position of the original document sheet to be scanned. Then, in step S07,  
it is determined whether the position, which is being scanned, is in the color image region to be compressed in multi level or  
25       in the image region to be compressed in binary. In the case of

the multi level color image, multi level color data is latched in step S09 before it is saved in the multi level color image memory in step S11. If it has been determined in step S07 that the position, which is being scanned, is  
5 in the binary image region, the color data item to be compressed in binary is latched in step S21. If the same is in the multi level color image region, "00" data or "FF" data is inserted as a blank data. Then, a binarization is performed in step S23, and it is then saved in the binary  
10 image memory in step S25.

In step S13, it is determined whether or not the saved data is the final data item in one line. If it has been determined that it is the final data, the flow advances to step S15 in which the multi level color data item is  
15 compressed before the binary compression and encoding are performed in step S29.

In step S31, it is determined whether or not data about all of the lines in one page of the original document has been processed. If it has been determined that the  
20 data processing of all of the lines has not been ended, the flow returns to step S05 in which the sensor is moved to the next scanning position so as to again perform the above-described processes. If it has been determined that the data processing of all of the lines has been ended,

vector information, multi level color image information and binary image data are transmitted in steps S33 to S37.

<Setting of image region information>

Next, a method of processing image data for an original in which the picture portion and the character portion must be separated from each other will be described.

As described above, the picture portion in one color original document is indicated with a frame. The information about the frame thus indicated is necessary to separate the multi level color image data including intermediate tone and the binary image data including characters in the image from each other. Furthermore, it must be decoded on the receipt side of the color facsimile machine. Therefore, the frame information must be as well as transmitted to the receipt side.

Figs. 4A and 4B show program information about Post Script as an example of window information which is information about the instructed frame.

For example, in order to, as shown in Fig. 4A, express the size of the frame of a BOX type window, vector data expressed by indicated program data ② ③ ④ and ⑤ displayed, as shown in M1, on a monitor can be used. Furthermore, the position of the BOX type window can be

freely indicated by changing data expressed by ① shown in the drawing.

Fig. 4B illustrates the frame of a circular window. In the case of Post Script, a circular window can be expressed by an indicated program data displayed on a monitor as shown in M2, that is, by data for one line.

The transmission side has no need to directly write the program of the type described above, information written by a pen or the like can be converted into program information shown in Fig. 4. The receipt side of the color facsimile apparatus prints the image while arranging the pictures and the characters in accordance with the thus converted information.

Although the description according to this embodiment is made about Post Script, which is usually used in a printer or the like, as the frame information, the present invention is not limited to the method in which the vector information is processed. Another method may be employed.

Fig. 5 illustrates a variety of frames. These frames can be processed by indicating the position and the type of the frame.

An optional frame can be easily drawn at an optional position by instructing the desired point as usually used in a picture drawing software for a personal computer.

<Reading of original document>

Fig. 6 illustrates the relationship between the position at which the original document is read and data. In the case where the portion of a document to be read includes both a picture and a character portion, image data includes both binary data and multi level color image data in a mixed manner. According to this embodiment, only the color image data is extracted from all of the data item and white data is inserted as an alternative to the extracted color image data. As a result, pictures and portions composed by character and others can be separated from one another when a color original document is transmitted by a color facsimile machine. That is, the picture portion is processed as color multivalued data capable of expressing the half tone image, while the character portion is processed as small value data such as binary data or quaternary data. As a result, the quantity of the image data to be transmitted can be reduced.

Fig. 7 is a timing chart for reading a color original document, wherein a case in which a frame contains a diagonal portion such as a parallelogram will be described.

The timing at which an original at a position designated by a line 1 is read is shown as timing 1. Image data read at the timing of a reading clock is divided into a binary data portion and a multi level color data portion in response to a color enable signal generated by frame

indication vector signal. The blank data "0" or "1" is inserted into binary data during the time in which the multi level color data is selected by the color enable signal.

5        A line 2 is the next line of the line 1 which is divided in such a manner that the color enable region is, as shown in Fig. 7, shifted by one pixel from the line 1 since the indicated frame is in the form of a parallelogram according to this embodiment.

10       Fig. 8 illustrates a timing chart for dividing data to latches 109, 111, 113 and 115 of the apparatus shown in Fig. 1.

<Transmission of image data>

15       Fig. 9 illustrates a status where image data is transmitted in such a manner that it is divided into color image data and character data. In this case, there is a necessity in that the above-described three types of data are divided and collectively transmitted regardless of the sequential order in which it is transmitted.

20       <Example of transmission according to this embodiment>

An example of the transmission performed by a color facsimile machine will be described.

Fig. 10A illustrates an example of the image original document which contains both characters and a color image.

25       According to this embodiment, the color image portion is

indicated as shown in Fig. 10B. In this case, the picture region is indicated by a rectangular frame. Fig. 10C illustrates an image formed by extracting only the color image portion. As shown in Fig. 10C, a picture portion is indicated so that a picture and a character portion are separated from each other. The above-described indication may be performed manually, but as an alternative to this, a structure may be employed in which the indication is made in such a manner that the color image portion and the characters are automatically recognized by the apparatus. Although the rectangular frames are illustrated in Figs. 10B and 10C, the present invention is not limited to this.

In the case where there arises a desire of deleting a portion in the color image or a case in which only a portion in a small frame is necessary, a double frame indication must be performed.

Referring to Fig. 11, Fig. 11A illustrates an original document containing both characters and a color image. In the case where only a portion of a color image of the original document shown in Fig. 11A is necessary, both the outer frame and the inner frame of the color image are indicated. In the method shown in Fig. 11B, a case is illustrated in which only the picture of a lap top personal computer is necessary but the picture of the printer is not necessary. Fig. 11C illustrates a case where an image from

which an unnecessary color image has been deleted is transmitted. Actually, the illustrated image data is transmitted as facsimile machine data. Therefore, a final image printed as shown in Fig. 11D can be obtained in the receipt side.

As described above, according to this embodiment, only data about a necessary region is indicated and transmitted as an alternative to transmitting the whole area of the color image data. Fig. 11 illustrates the case where there is a picture which is desired to be deleted. According to this embodiment, a double frame indication is performed in order to prevent a problem taking place in that the unnecessary picture portion is read as character data in a case where the picture portion has a large marginal area or in a case where an unnecessary portion is desired to be deleted.

Then, the operation at the time of the data transmission will be described with reference to Fig. 12.

Fig. 12A illustrates the process of data for a character portion.

According to this embodiment, color image data for the original document is cut out and masked so as to insert "blank data". Actually, "0" or "1" is inserted into the masked portion. Then, the image data for the image to which the blank data has been inserted as an alternative to

the color image is compressed by an encoding method, for example, MH, MR or MMR encoding method. In the case where the MH, MR and MMR encoding methods, the compression efficiently is improved in proportion to the quantity of the blank data. Furthermore, the insertion of the blank data as an alternative to the color image will cause the receipt side of a facsimile machine to automatically make a color image region.

Fig. 12B illustrates the process of data for the color image portion. According to the process described above, the color image data is limited to only the portion in the inner frame and the frame is individually stored as vector information in the CPU. Therefore, even if an image is irregular as shown in Fig. 12B, it can be subjected to the color image compression process. As the method of compressing the color image data of the type described above, an orthogonal conversion method, a vector quantization method and a method including the above-described two methods may be employed.

As described above, according to this embodiment, a color original document is temporarily read by the RGB scanner before the binary image portion and the multi level color image portion are, as described above, separated from each other so as to be individually transmitted.

Therefore, the color image data and the image data composed

by character and others can be efficiently compressed, causing the necessary time to complete the data transmission to be significantly shortened.

According to this embodiment, also the data composed  
5 by character and others is read by the scanner which is capable of reading the RGB color data so that the black and white character data and the color data are distinguished from each other. However, in a case where the scanner portion is structured to comprise an optical system  
10 arranged to exclusively read black and white or monochrome character data, a further accurate character data can be obtained so as to be printed. Therefore, a CCD on which a color filter is mounted is employed in the reading portion so as to read color data. Furthermore, a structure may be  
15 employed which is arranged to further comprise a scanner by using a CCD having no color filter so as to read monochromatic data. In this case, a sensor arranged to be capable of sensing black and white or monochrome image is necessary to be provided and a further system must be  
20 provided as the signal processing circuit. However, more accurate black data than that processed by the RGB scanner can be obtained. Specifically, a structure may be employed which is arranged in such a manner that a black and white character data reading portion is provided for the RGB  
25 scanner portion 101.

As described above, according to the procedure for transmitting data by using a color facsimile machine, a picture portion and a character portion are individually processed when a color image is transmitted. Therefore, the data compression can be efficiently performed depending upon the characteristics of the two types of the data items. Therefore, the necessity of transmitting an excessively large quantity of data can be eliminated at the time of the color facsimile transmission. Furthermore, the data compression efficiency can be improved by inserting blank data into a portion which has been determined to be a picture in the character portion. In addition, a procedure for marking the above-described portion can be eliminated. The character portion is, similarly to the conventional black and white facsimile machine, processed as character image data so that the procedure of converting the characters into codes can be eliminated. Therefore, the character portion can be simply processed. As described above, the color data and the black and white or monochrome data can be transmitted while mixing at the time of transmitting data by a color facsimile machine.

According to this embodiment, only the positional information about the color image portion is transmitted as vector information as shown in Fig. 9 when color image portions and binary image portions are successively

transmitted. However, only positional information about the binary image portion may be transmitted or positional information about the two types of the positions may be transmitted. The above-described positional information is  
5 not limited to the vector information. As an alternative to this, a method may be employed in which coordinates are simply transmitted.

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Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form may be . changed in the details of construction and  
15 the combination and arrangement of parts .



CLAIMS:

1. A method of transmitting image data representing an image having a colour image area and a monochrome area,  
5 the method comprising:

generating first compressed data for the region containing both said areas but in which one of the areas is replaced by a blank;

- 10 generating second compressed data for the area which is replaced by a blank in the first compressed data; and

transmitting the first and second compressed data together with positional data relating to the position of at least one of the said areas.

- 15 2. A method according to claim 1, in which the first and second compressed data are compressed by different data compression methods.

- 20 3. A method according to claim 1 or claim 2 in which the area which is replaced by a blank is the colour image area.

4. A method according to claim 3 in which the second compressed data is compressed by an ADCT method.

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5. A method according to claim 3 or claim 4 in which the first compressed data is compressed by an arithmetic-



coded method.

6. A method according to claim 3 or claim 4 in which the first compressed data is compressed by one of MH, MR and MMR encoding methods.

7. A method according to any one of the preceding claims in which the blank is expressed as data "0".

8. A method according to any one of the preceding claims in which the positional data is vector data.

9. Apparatus for transmitting image data representing an image having a colour image area and a monochrome area, the apparatus comprising means for:

generating first compressed data for the region containing both said areas but in which one of the areas is replaced by a blank;

generating second compressed data for the area which is replaced by a blank in the first compressed data; and

transmitting the first and second compressed data together with positional data relating to the position of at least one of the said areas.

10. Apparatus according to claim 9 in which the first and second compressed data are compressed by different data compression methods.



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11. Apparatus according to claim 9 or claim 10 in which the area which is replaced by a blank is the colour image area.

5 12. Apparatus according to claim 11 in which the second compressed data is compressed by an ADCT method.

10 13. Apparatus according to claim 11 or claim 12 in which the first compressed data is compressed by an arithmetic-coded method.

14. Apparatus according to claim 11 or claim 12 in which the first compressed data is compressed by one of MH, MR and MMR encoding methods.

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15. Apparatus according to any one of claims 9 to 14 in which the blank is expressed as data "0".

20 16. Apparatus according to any one of claims 9 to 15 in which the positional data is vector data.

17. An image transmission method substantially as herein described with reference to the drawings.

25 18. An image transmission apparatus substantially as herein described with reference to the drawings.

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