

DATA PROCESSING APPARATUS AND METHOD AND PROGRAM THEREFOR

Technical Field

This invention relates to a data processing apparatus and method and a program therefor wherein data are written into and read out from a recording medium.

Background Art

In recent years, a radio frequency identification (RFID) technique has exhibited a significant development, and various techniques have been proposed wherein an RFID tag (radio tag) which can transmit and receive data by radio and requires no power supply is utilized for various information providing means.

For example, a system has been proposed wherein a radio tag is applied to a poster or the like and file data recorded in the radio tag are read by radio by means of a terminal apparatus such as a portable telephone set or a personal digital assistant (PDA).

In such a system as just described, it is necessary to take measures for preventing a third party from illegally writing file data into a radio tag applied to a

poster.

A system of the type described is disclosed, for example, in Japanese Patent Laid-Open No. 2003-85494.

Memories for use with a radio tag are divided into a type which has a rewriting inhibiting function and another type which does not have the rewriting inhibiting function. Of whichever one of the types the memory used in a radio tag is, it is necessary to prevent file data written illegally in the radio tag by a third party from being read out and utilized in error as valid file data.

Disclosure of Invention

It is an object of the present invention to provide a data processing apparatus and method and a program therefor which can prevent recording data written illegally into a recording medium by a third party from being read out and utilized as valid recording data in error irrespective of whether or not the recording medium in which the recording data are written has a rewriting inhibiting function.

A data processing apparatus for writing recording data into a recording medium of the first invention is provided. The apparatus is characterized in that it includes: a signature production means for producing

signature data for the recording data; and a writing means for discriminating whether or not the recording medium has a writing inhibiting function and performing, when it is discriminated that the recording medium has the writing inhibiting function, a first operation of writing the recording data into the recording medium but performing, when it is discriminated that the recording medium does not have the writing inhibiting function, a second operation of writing the signature data produced by the signature production means and the recording data into the recording medium.

The data processing apparatus of the first invention functions as below.

The writing means discriminates whether or not a recording medium has a writing inhibiting function. When the writing means discriminates that the recording medium has the writing inhibiting function, the writing means performs the first operation of writing the recording data into the recording medium. However, when the writing means discriminates that the recording medium does not have the writing inhibiting function, the writing means performs the second operation of writing the signature data produced by the signature production means and the recording data into the recording medium.

A data processing method of the second invention is characterized in that it includes: a first step of discriminating whether or not a recording medium has a writing inhibiting function; a second step of writing, when it is discriminated at the first step that the recording medium has the writing inhibiting function, recording data into the recording medium; a third step of producing, when it is discriminated at the first step that the recording medium does not have the writing inhibiting function, signature data for the recording data; and a fourth step of writing the signature data produced at the third step and the recording data into the recording medium.

A program of the third invention for being executed by a data processing apparatus is characterized in that it causes the data processing apparatus to execute: a first procedure of discriminating whether or not a recording medium has a writing inhibiting function; a second procedure of writing, when it is discriminated at the first procedure that the recording medium has the writing inhibiting function, recording data into the recording medium; a third procedure of producing, when it is discriminated at the first procedure that the recording medium does not have the writing inhibiting

function, signature data for the recording data; and a fourth procedure of writing the signature data produced at the third procedure and the recording data into the recording medium.

A data processing apparatus for reading out recording data from a recording medium of the fourth invention is provided. The apparatus is characterized in that it includes: a signature verification means for verifying signature data for the recording data; and a reading out means for discriminating whether or not the recording medium has a writing inhibiting function and performing, when it is discriminated that the recording medium has the writing inhibiting function, a first operation of reading out the recording data from the recording medium and utilizing the recording data but performing, when it is discriminated that the recording medium does not have the writing inhibiting function, a second operation of reading out the recording data from the recording medium, causing the signature verification means to verify signature data included in the reading data read out from the recording medium and utilizing the recording data read out from the recording medium if a condition that the signature verification means discriminates that the signature data is valid is

satisfied.

The data processing apparatus of the fourth invention functions as below.

The reading out means discriminates whether or not the recording medium has a writing inhibiting function. When the reading out means discriminates that the recording medium has the writing inhibiting function, the reading out means reads out the recording data from the recording medium and utilizes the recording data. However, when the reading out means discriminates that the recording medium does not have the writing inhibiting function, the reading out means reads out the recording data from the recording medium, and causes the signature verification means to verify signature data included in the reading data read out from the recording medium. Then, the reading out means utilizes the recording data read out from the recording medium if a condition that the signature verification means discriminates that the signature data is valid is satisfied.

A data processing method of the fifth invention for reading out recording data from a recording medium is provided. The method is characterized in that it includes: a first step of discriminating whether or not the recording medium has a writing inhibiting function; a

second step of reading out, when it is discriminated at the first step that the recording medium has the writing inhibiting function, the recording data from the recording medium and utilizing the recording data; a third step of reading out, when it is discriminated at the first step that the recording medium does not have the writing inhibiting function, the recording data from the recording medium and verifying signature data included in the reading data read out from the recording medium; and a fourth step of utilizing the recording data read out from the recording medium if a condition that it is discriminated at the third step that the signature data is valid is satisfied.

A program of the sixth invention for being executed by a data processing apparatus is provided. The program is characterized in that it causes the data processing apparatus to execute: a first procedure of discriminating whether or not the recording medium has a writing inhibiting function; a second procedure of reading out, when it is discriminated at the first procedure that the recording medium has the writing inhibiting function, the recording data from the recording medium and utilizing the recording data; a third procedure of reading out, when it is discriminated at the first procedure that the

recording medium does not have the writing inhibiting function, the recording data from the recording medium and verifying signature data included in the reading data read out from the recording medium; and a fourth procedure of utilizing the recording data read out from the recording medium if a condition that it is discriminated at the third procedure that the signature data is valid is satisfied.

With the present invention, recording data written illegally into a recording medium by a third party can be prevented from being read out and utilized as valid recording data in error irrespective of whether or not the recording medium has a rewriting inhibiting function.

Brief Description of Drawings

FIG. 1 is a block diagram showing a general configuration of a data distribution system to which the present invention is applied;

FIG. 2 is a block diagram showing a configuration of a radio tag which has a writing inhibiting function shown in FIG. 1;

FIG. 3 is a block diagram showing a configuration of a radio tag which has no writing inhibiting function shown in FIG. 1;

FIG. 4 is a diagrammatic view illustrating a memory map configuration of a memory of the radio tags shown in FIGS. 2 and 3;

FIG. 5 is a diagrammatic view illustrating a file data area shown in FIG. 4 where file data which are not in a compressed form are recorded in the radio tag shown in FIG. 2;

FIG. 6 is a diagrammatic view illustrating the file data area shown in FIG. 4 where file data which are not in a compressed form are recorded in the radio tag shown in FIG. 3;

FIG. 7 is a diagrammatic view illustrating the file data area shown in FIG. 4 where compressed file data are recorded in the radio tag shown in FIG. 2;

FIG. 8 is a diagrammatic view illustrating the file data area shown in FIG. 4 where compressed file data are recorded in the radio tag shown in FIG. 3;

FIG. 9 is a diagrammatic view showing a file table area shown in FIG. 4;

FIG. 10 is a diagrammatic view showing a file attribute area shown in FIG. 9;

FIG. 11 is a block diagram showing a hardware configuration of a writing apparatus shown in FIG. 1;

FIG. 12 is a flow chart illustrating an

initialization operation of a radio tag by the writing apparatus shown in FIGS. 1 and 11;

FIG. 13 is a flow chart illustrating a general writing operation of file data and so forth into a radio tag by the writing apparatus shown in FIGS. 1 and 11;

FIGS. 14 and 15 are flow charts illustrating details of a writing operation of file data and so forth into a radio tag at step ST13 or ST14 illustrated in FIG. 13;

FIG. 16 is a block diagram showing a hardware configuration of a terminal apparatus shown in FIG. 1;

FIG. 17 is a flow chart illustrating a general reading out operation from a radio tag by the terminal apparatus shown in FIGS. 1 and 16; and

FIGS. 18 and 19 are flow charts illustrating details of a reading out operation of file data, file attribute data and so forth at step ST43 or ST45 shown in FIG. 17.

Best Mode for Carrying out the Invention

Referring first to FIG. 1, there is shown a general configuration of a data distribution system to which the present invention is applied.

In the data distribution system which is generally

denoted at 1, a plurality of file data of a variable size such as HTML (Hypertext Markup Language) file data produced, for example, by a computer 12 are written by radio into a radio tag 10 through a writing apparatus 11.

The radio tag 10 is applied to a poster 18 or the like.

A terminal apparatus 15 of the portable type reads out the file data by radio from the radio tag 10 and displays an image according to the file data, for example, on a display unit thereof.

The terminal apparatus 15 may be, for example, a portable telephone set or a personal digital assistant (PDA).

First, a corresponding relationship between features of the present invention and components of the present embodiment is described.

A memory 35 of the radio tags 10 and 10a shown in FIG. 1 corresponds to a recording medium in the present invention. A recording area of the memory 35 shown in FIG. 4 corresponds to a recording area of the present invention.

The radio tag 10 shown in FIG. 2 is a recording medium which has the writing inhibiting function, and the radio tag 10a shown in FIG. 3 is a recording medium which

does not have the writing inhibiting function.

File data recorded in a file area 142 in the recording area shown in FIG. 5 in the present embodiment correspond to recording data of the present invention.

Signature data recorded in a signature area 143 or 150 shown in FIG. 6 or 8 corresponds to signature data in the present invention.

Further, file attribute data recorded in file attribute areas 120_1 to 120_n (n is an integer equal to or greater than 1) shown in FIG. 9 correspond to attribute data of the present invention.

An address recorded in a file position designation area 121 shown in FIG. 10 corresponds to a recording address of the present invention.

Further, a first address A shown in FIG. 9 corresponds to a first address of the present invention, and a second address B corresponds to a second address of the present invention.

In the present embodiment, the first address A indicates a top address of a file data area 102 following a tag management area 101 designated from the top address in the recording area shown in FIG. 9.

The second address B indicates an address on the tail end address side in a region following a parity area

114, a reserved area 113, a free area indication area 112, a file number area 111 and a classification type area 115 defined in order from the tail address in the recording area shown in FIG. 9.

Further, a processing section 25 shown in FIG. 11 corresponds to a first writing means of the present invention according to the first aspect, and a signature production section 26 corresponds to a signature production means of the present invention according to the first aspect. Further, a program PRG1 shown in FIG. 11 corresponds to a program of the present invention according to the third aspect.

A processing section 45 shown in FIG. 16 corresponds to a reading out means of the present invention according to the fourth aspect, and a signature verification section 46 corresponds to a signature verification means of the present invention according to the fourth aspect. Further, a program PRG2 shown in FIG. 16 corresponds to a program of the present invention according to the sixth aspect.

Now, an outline of the data distribution system 1 is described.

When the writing apparatus 11 of the data distribution system 1 writes file data and so forth into

a radio tag 10 which has a writing inhibiting function, it sets the radio tag 10 to a write inhibiting state after it writes the file data and so forth into the radio tag 10.

On the other hand, when the writing apparatus 11 writes file data and so forth on a radio tag 10a which does not have the writing inhibiting function, it produces signature data for the file data and writes the signature data into the radio tag 10a together with the file data and so forth.

In such writing of file data as described above, the writing apparatus 11 writes a plurality of file data of a variable size in order into a file data area 102 in a recording area shown in FIG. 9 beginning with a first address A toward a second address B in the radio tag 10.

Further, the writing apparatus 11 writes a plurality of file attribute data of a fixed size individually defined corresponding to the plurality of file data and individually indicating recording addresses of corresponding file data in the file data area 102 into prescribed file attribute areas 120_n beginning with the second address B toward the first address A.

The terminal apparatus 15 reads out the filed data, file attribute data and so forth from the radio tag 10

but does not perform verification of signature data.

In particular, since the radio tag 10 is set to the writing inhibiting state, a third party cannot write file data illegally into the radio tag 10.

On the other hand, the terminal apparatus 15 reads out the file data and file attribute data as well as signature data from the radio tag 10a. Then, after the terminal apparatus 15 verifies the validity of the signature data, it utilizes the file data, file attribute data and so forth read out as described above as valid data.

Since the radio tag 10a does not have the writing inhibiting function, a third party can write file data illegally into the radio tag 10a. However, since the terminal apparatus 15 performs verification of signature data, such illegal writing as described above can be detected appropriately, and the file data can be prevented from being utilized in error.

[Radio tags 10 and 10a]

The radio tag 10 has the writing inhibiting function while the radio tag 10a does not have the writing inhibiting function.

FIG. 2 shows a configuration of the radio tag 10 shown in FIG. 1.

Referring to FIG. 2, the radio tag 10 includes an antenna 31, a radio frequency (RF) section 32, a power control section 33, a memory accessing section 34 and a memory 35.

The RF section 32 performs such processing as demodulation and so forth for a signal such as file data, file attribute data and so forth received by the antenna 31 and outputs a resulting signal to the memory accessing section 34.

The RF section 32 performs such processing as modulation and so forth for a signal such as file data, attribute data and so forth read out from the memory 35 and supplies a resulting signal to the antenna 31.

The power control section 33 supplies power (energy) obtained by electromagnetic coupling from a signal received through the antenna 31 to the memory accessing section 34 and so forth.

The memory accessing section 34 is driven with the power received from the power control section 33 and performs a writing operation and a reading out operation of data into and from the memory 35.

The memory accessing section 34 has the writing inhibiting function and is controlled, for example, by the writing apparatus 11 and the terminal apparatus 15.

The memory 35 stores data such as file data and file attribute data hereinafter described.

The memory 35 is a recording medium such as, for example, a smart label or an EEPROM from which recording data are erased by collective erasure for the entire recording area thereof.

FIG. 3 shows a configuration of the radio tag 10a shown in FIG. 1.

Referring to FIG. 3, the radio tag 10a includes an antenna 31, a radio frequency (RF) section 32, a power control section 33, a memory accessing section 34a and a memory 35.

The antenna 31, RF section 32, power control section 33 and memory 35 are similar to those described hereinabove with reference to FIG. 2.

The radio tag 10a is different from the radio tag 10 in that the memory accessing section 34a thereof does not have the writing inhibiting function.

FIG. 4 illustrates a configuration of a memory map of the memory 35 of the radio tags 10 and 10a shown in FIGS. 2 and 3.

The memory 35 permits accessing thereto from the outside except part of the recording area in which an OS (Operating System) and information regarding the radio

tag 10 or 10a such as whether or not it has the writing inhibiting function, a manufacture code, a version, a size of the recording area of the memory 35, a unit in accessing to the recording area and so forth.

As seen in FIG. 4, the recording area of the memory 35 includes a tag management area 101, a file data area 102 and a file table area 103.

The tag management area 101 is defined, for example, over a predetermined address range from the starting (top) address of an address space of the recording area of the memory 35 shown in FIG. 4.

The tag management area 101 has recorded therein data unique to the radio tag 10 or 10a.

The file data area 102 is defined between the tag management area 101 and the file table area 103 in the address space described above.

The file data area 102 is defined from the first address A following the tag management area 101 shown in FIG. 9 described hereinabove toward the second address B of the address space of the memory 35.

In the file data area 102 of the radio tag 10, file name data of a plurality of HTML file data and the entity of the file data are written in order as seen in FIG. 5 at successive addresses from the first address A toward

the second address B by the writing apparatus 11.

In particular, file name data are recorded in the file name area 141 in the file data area 102, and file data are recorded in the file area 142.

The individual file name data and file data are data of a variable size.

The size of the file data area 102 varies depending upon the number and the data amount of file data recorded therein.

On the other hand, in the file data area 102 of the radio tag 10a, file name data of a plurality of HTML file data, signature data and the entity of the file data are written in order as seen in FIG. 6 at successive addresses from the first address A toward the second address B by the writing apparatus 11.

In particular, file name data are recorded in a file name area 141 in the file data area 102, and signature data are recorded in the signature area 143. Further, file data are recorded in the file area 142.

When compressed file data obtained by compressing file data are to be recorded into the file data area 102 of the radio tag 10. The compressed file data are recorded into a compressed file area 153 as seen in FIG. 7.

In this instance, a recording size area 151 and a compression type area 152 are defined between the file name area 141 and the compressed file area 153.

In the recording size area 151, the size (data length) of the compressed file data recorded in the compressed file area 153 is recorded.

In the compression type area 152, identification data of the compression method used for the production of the compressed file data is recorded.

As the compression method, for example, run length coding, Huffman coding, LZ77 coding, LZ78 coding, block sorting, MTF coding, arithmetic compression, a range coder method and so forth can be used.

Meanwhile, in the file data area 102 of the radio tag 10a, signature data is recorded in a signature area 150 as seen in FIG. 8.

Further, in the file data area 102 of the radio tag 10a, when compressed file data obtained by compressing file data are to be recorded, the compressed file data are recorded in the compressed file area 153 as seen in FIG. 8.

The file table area 103 is defined from the second address B of the address space toward the first address A.

A file table is recorded in the file table area 103.

FIG. 9 illustrates a detailed configuration of the file table area 103 shown in FIG. 4.

Referring to FIG. 9, the file table area 103 includes a file number area 111, a free area indication area 112, a reserved area 113, a parity area 114, a classification type area 115, and a single or a plurality of file attribute areas 120_n (n is an integer equal to or greater than 1).

In the file table area 103, the parity area 114, reserved area 113, free area indication area 112, file number area 111 and classification type area 115 are defined in order, for example, from the tail address of the memory space of the memory 35.

Further, a plurality of file attribute areas 120_n are defined from the second address B side toward the first address A.

It is to be noted that the areas 111 to 115 and 120_n in the file table area 103 individually have fixed sizes.

In particular, in the memory 35, a plurality of file data and so forth are recorded in order from the first address A following the tag management area 101 toward the address B, and a plurality of file attribute data individually corresponding to the file data are

recorded in order in the plurality of file attribute areas 120_n from the second address B side toward the first address A.

The file number area 111 indicates the number of file data recorded in the file data area 102.

It is to be noted that, also where not the entity of file data but information regarding file data such as file name data is recorded into the file data area 102, it is counted into the number of files.

The free area indication area 112 indicates the top address in the file data area 102 into which next new file data is to be written.

The reserved area 113 is a region reserved to record some data in the future.

The parity area 114 is used to record parity data for verifying the validity of the file number area 111, free area indication area 112 and reserved area 113.

The classification type area 115 is used to record, where the individual radio tag 10 has an application, a classification according to the application.

The file attribute areas 120_n are used to record file attribute data corresponding to individual file data recorded in the file data area 102.

It is to be noted that, where a file attribute area

120_n relates a shortcut, file attribute data corresponding to file name data recorded in the file data area 102 is recorded in the file attribute area 120_n.

FIG. 10 shows a configuration of the file attribute area 120_n shown in FIG. 9.

Referring to FIG. 10, the file attribute area 120_n includes a file position designation area 121, a file type area 122, a file production time area 123, a file name size area 124, a file size reference area 125, a reserved area 126 and a parity area 127.

The file position designation area 121 is used to record file data corresponding to the file attribute area 120_n or an address (recording address, according to the present invention) in the file data area 102 at which file name data is recorded.

The file type area 122 is used to record type data representative of types such as: whether or not corresponding file data recorded in the file data area 102 is in a compressed form; or whether or not signature data is present.

The file production time area 123 is used to record time data representative of time at which file data or file name data corresponding to the file attribute area 120_n is recorded in the file data area 102.

The file name size area 124 is used to record the size (data length) of file name data recorded in the file data area 102.

The file size reference area 125 is used to record, where file data corresponding to the file data area 102 is recorded, the size of the file data.

However, where compressed file data is recorded in the compressed file area 153 as seen in FIGS. 6 and 8, the file size reference area 125 is used to record the size of the file data prior to the compression.

The parity area 127 is used to record parity data for verifying the validity of the data of the file position designation area 121, file type area 122, file production time area 123, file name size area 124, file size reference area 125 and reserved area 126.

[Writing apparatus 11]

The writing apparatus 11 writes data in the format described hereinabove with reference to FIGS. 4 to 10 into the memory 35 of the radio tag 10 or 10a.

In particular, when the writing apparatus 11 writes file data and so forth into the radio tag 10 which has the writing inhibiting function, it sets the radio tag 10 to a writing inhibition state after it writes the file data and so forth into the radio tag 10.

On the other hand, when the writing apparatus 11 writes file data and so forth into the radio tag 10a which does not have the writing inhibiting function, it produces signature data for the file data and writes the signature data into the radio tag 10a together with the file data and so forth.

Thus, the writing apparatus 11 can prevent file data and so forth recorded in the radio tag 10 or 10a from being illegally rewritten by a third party.

Further, the writing apparatus 11 writes a plurality of file data of a variable size and file name data in order beginning with the first address A toward the address B in the file data area 102 in the recording area illustrated in FIG. 9 of the memory 35 of the radio tag 10 or 10a shown in FIG. 2 or 3.

Furthermore, the writing apparatus 11 writes a plurality of file attribute data of a fixed size individually defined corresponding to the plurality of file data described hereinabove and indicating recording addresses in the file data area 102 of the corresponding file data in order into the file attribute areas 120_n from the second address B side toward the first address A.

Consequently, the terminal apparatus 15 can specify an address at which file attribute data is recorded in

the recording region of the memory 35 without being influenced by file data of a variable size and so forth.

Further, an address at which file data and so forth are recorded in the recording area can be specified from an address recorded in the file position designation area 121 shown in FIG. 10.

Further, the writing apparatus 11 records file number data into the file number area 111 in the file table area 103 as seen in FIG. 9. Since the size of the file attribute areas 120_n is fixed, the terminal apparatus 15 can easily specify addresses which form the file table area 103.

Further, the writing apparatus 11 can set the size of file name data freely within a range defined by the bit number of the file name size area 124 by designating the size of file name data in the file name size area 124 and varying the size of the file name area 141 in the file data area 102 shown in FIGS. 4 and 5. For example, where the file name size area 124 is set to 8 bits, the writing apparatus 11 can write file name data up to 255 bytes in the maximum into the file data area 102.

Therefore, the writing apparatus 11 can write file name data of a tree structure such as
"/HTML4.0/index.html" or "/cHTML/index.html" which

differs, for example, depending upon the model of the terminal apparatus 15 into the file data area 102.

Further, where the shortcut described above is used, only it is necessary to write a single file data for a plurality of different file name data into the file data area 102. Consequently, the recording area of the memory 35 can be utilized efficiently.

FIG. 11 shows a hardware configuration of the writing apparatus 11 shown in FIG. 1.

Referring to FIG. 11, the writing apparatus 11 includes an interface 21, an RF section 22, an antenna 23, a memory 24, a processing section 25 and a signature production section 26 which are connected to each other by a data line 20.

The interface 21 transfers data to and from the computer 12 shown in FIG. 1.

The RF section 22 transfers data by radio to and from the radio tag 10 through the antenna 23.

The memory 24 is used to record a program PRG1 which defines processing of the processing section 25 and various data used for the processing of the processing section 25.

The processing section 25 generally controls such processing of the writing apparatus 11 as described

hereinabove or hereinafter described based on the program PRG1.

The signature production section 26 uses, for example, secret key data of the writing apparatus 11 to produce signature data for file data to be written into the radio tag 10a.

In the following, an example of operation of the writing apparatus 11 is described.

It is to be noted that, in the following example of operation, communication between the processing section 25 and the radio tag 10 or 10a is performed through the RF section 22 and the antenna 23 shown in FIG. 11.

Further, writing into and reading out from the memory 35 of the radio tag 10 or 10a by the processing section 25 is performed in response to an instruction issued from the processing section 25 to the memory accessing section 34 of the radio tag 10 or 10a.

[Initialization operation of the radio tag 10]

FIG. 12 illustrates an initialization operation of the radio tag 10 or 10a by the writing apparatus 11.

Step ST1:

The processing section 25 of the writing apparatus 11 discriminates whether or not radio communication with a radio tag 10 or 10a is possible through the RF section

22 and the antenna 23. If the processing section 25 discriminates that such radio communication is possible, then it advances its processing to step ST2, but in the other case, the processing section 25 performs an error process.

Step ST2:

The processing section 25 reads out tag data recorded in the memory 35.

The tag data include information of, for example, whether or not the radio tag 10 or 10a has the rewriting inhibiting function, a manufacture code, a version, the size of the recording area of the memory 35, and a unit of accessing to the recording area.

Step ST3:

The processing section 25 determines a size and a format of the tag management area 101 shown in FIG. 9 based on the tag data inputted at step ST2.

As a result, the tag management area 101 can be defined in accordance with the characteristics of the radio tag 10.

Then, the processing section 25 writes predetermined tag management data into the tag management area 101 illustrated in FIG. 9 of the radio tag 10 or 10a.

Step ST4:

The processing section 25 defines the file table area 103 of a predetermined size beginning with the second address B in the recording area illustrated in FIG. 9.

Step ST5:

The processing section 25 writes initial data into the file number area 111, free area indication area 112, reserved area 113, parity area 114 and classification type area 115 illustrated in FIG. 9 in the file table area 103 defined at step ST4.

Step ST6:

The processing section 25 discriminates whether or not the writing at step ST5 results in success. If the writing results in success, then the processing section 25 ends the processing, but if the writing results in failure, then the processing section 25 advances the processing to step ST7.

Step ST7:

The processing section 25 discriminates whether or not the number of times by which the writing at step ST5 is repeated is lower than a predetermined re-processing time number. If the processing section 25 discriminates that the number of times is smaller than the predetermined re-processing time number, then the

processing section 25 returns the processing to step ST5, but in the other case, the processing section 25 executes an error process.

[Writing operation of file data and so forth]

FIG. 13 illustrates a general writing procedure of file data and so forth into the radio tag 10 or 10a by the writing apparatus 11.

Step ST11:

The processing section 25 of the writing apparatus 11 reads out, in accordance with a writing instruction received from the computer 12 through the interface 21, data representative of whether or not the writing inhibiting function is included in tag data from the memory 35 of the radio tag 10 or 10a through the RF section 22 and the antenna 23.

Step ST12:

The processing section 25 discriminates, based on the data read out at step ST11, whether or not the radio tag 10 or 10a has the writing inhibiting function. If the processing section 25 discriminates that the radio tag 10 or 10a has the writing inhibiting function, then the processing section 25 advances the processing to step ST13, but in the other case, the processing section 25 advances the processing to step SG17.

More particularly, if the writing apparatus 11 is to perform writing into the radio tag 10, then the processing advances to step ST13, but if the writing apparatus 11 is to perform writing into the radio tag 10a, the processing advances to step ST17.

Step ST13:

The processing section 25 writes the file data and so forth into the memory 35 of the radio tag 10. In this instance, the processing section 25 does not write signature data into the memory 35.

The operation in this instance is hereinafter described in more detail.

Step ST14:

The processing section 25 discriminates whether or not the writing at step ST13 results in success. If the processing section 25 discriminates that the writing results in success, then the processing section 25 advances the processing to step ST15, but in the other case, the processing section 25 executes an error process.

Step ST15:

The processing section 25 outputs a writing inhibiting instruction to the memory accessing section 34 of the radio tag 10 shown in FIG. 2.

Consequently, the memory accessing section 34

places the memory 35 into a later writing inhibiting state.

Step ST16:

The processing section 25 discriminates whether or not the writing inhibiting process at step ST15 results in success. If the processing section 25 discriminates that the writing inhibiting process results in success, then it ends the processing, but in the other case, the processing section 25 performs an error process.

Step ST17:

The processing section 25 outputs, when writing into the radio tag 10a is to be performed, for example, a signature production instruction to the signature production section 26.

The signature production section 26 uses, in accordance with the signature production instruction, the secret key data of the writing apparatus 11 to produce signature data for the file data to be written into the radio tag 10a.

Step ST18:

The processing section 25 writes the signature data produced at step ST17 into the signature area 143 illustrated in FIG. 6 or 8 of the memory 35 of the radio tag 10a.

Further, the processing section 25 writes the file data and so forth into the memory 35 as hereinafter described.

Step ST19:

The processing section 25 discriminates whether or not the writing at step ST18 results in success. If the processing section 25 discriminates that the writing results in success, then it ends the processing, but in the other case, the processing section 25 performs an error process.

Now, details of the writing operation of file data into the radio tag 10 or 10a at step ST13 or ST18 illustrated in FIG. 13 by the writing apparatus 11 are described.

FIGS. 14 and 15 illustrate the writing operation.

Step ST21:

The processing section 25 of the writing apparatus 11 discriminates whether or not file name data inputted together with the writing instruction from the computer 12 through the interface 21 is valid. If the processing section 25 discriminates that the file name data is valid, then the processing section 25 advances the processing to step ST22, but in the other case, the processing section 25 performs an error process.

For example, if the processing section 25 receives a file name to which ".html" is not added as an identifier, then it discriminates that the file name data is not valid.

Step ST22:

The processing section 25 reads out, based on addresses recorded in the file position designation area 121 of all of the file attribute areas 120_n shown in FIG. 10 in the file table area 103 of the memory 35 of the radio tag 10 or 10a, file name data recorded in the file name area 141 in the file data area 102 shown in FIGS. 4 to 8.

At this time, the processing section 25 specifies the file position designation area 121 in each file attribute area 120_n based on the second address B, the file number indicated by the file number area 111, the size of the file attribute area 120_n and so forth illustrated in FIG. 9.

Step ST23:

The processing section 25 discriminates whether or not the file name data read at step ST22 include the file name data designated at step S21. If the processing section 25 discriminates that the file name data do not include the designated file name data, then it advances

the processing to step ST24. However, if the processing section 25 discriminates that the file name data include the designated file name data, then it performs an error process.

Step S24:

The processing section 25 discriminates whether or not the file number data recorded in the file number area 111 illustrated in FIG. 9 of the memory 35 of the radio tag 10 or 10a is smaller than, for example, the maximum file number defined by the tag data obtained by the process illustrated in FIG. 13. If the processing section 25 discriminates that the file number data is smaller than the maximum file number, then it advances the processing to step ST25, but in the other case, the processing section 25 performs an error process.

Step ST25:

The processing section 25 compresses the file data inputted from the computer 12 through the interface 21 shown in FIG. 11 using a predetermined compression method to produce compressed file data.

Step ST26:

The processing section 25 discriminates whether or not the size of the compressed file data produced at step ST25 is smaller than the size of the file data prior to

the compression. If the processing section 25 discriminates that the size of the compressed file data is smaller, then it advances the processing to step ST27, but in the other case, the processing section 25 advances the processing to step ST28.

Step ST27:

The processing section 25 selects the compressed data file produced at step ST25 as data to be recorded into the file data area 102 of the memory 35 of the radio tag 10 or 10a.

Step ST28:

The processing section 25 selects the data file prior to the compression at step ST25 as data to be recorded into the file data area 102 of the memory 35 of the radio tag 10 or 10a.

Step ST29:

The processing section 25 calculates a recording capacity to record the compressed file data or the file data selected at step ST27 or ST28 into the file data area 102 of the radio tag 10 or 10a.

Step ST30:

The processing section 25 specifies a free capacity of the memory 35, for example, from the file number data and the address read out from the file number area 111

and the free area indication area 112 illustrated in FIG. 9 of the memory 35 of the radio tag 10.

Step ST31:

The processing section 25 discriminates whether or not the recording capacity calculated at step ST29 is smaller than the free recording capacity specified at step ST30. If the processing section 25 discriminates that the recording capacity is smaller than the free recording capacity, then it advances the processing to step ST32, but in the other case, the processing section 25 performs an error process.

Step ST32:

The processing section 25 writes the file data prior to the compression or the file data after the compression and so forth into the memory 35 of the radio tag 10 or 10a.

For example, when the file data prior to the compression are to be written into the memory 35, the processing section 25 first writes, beginning with the address read out from the free area indication area 112 illustrated in FIG. 9 of the memory 35 toward the second address B, the file name data inputted at step ST21. Then, the processing section 25 writes the size of the compressed file data into the recording size area 151,

writes the compression method into the compression type area 152 and then writes the compressed file data into the compressed file area 153 as seen in FIGS. 7 and 8.

Step ST33:

The processing section 25 discriminates whether or not the writing at step ST32 results in success. If the processing section 25 discriminates that the writing results in success, then it advances the processing to step ST35, but if the processing section 25 discriminates that the writing results in failure, then it advances the processing to step ST34.

Step ST34:

The processing section 25 discriminates whether the number of times of the writing at step ST32 is smaller than a predetermined re-processing time number. If the processing section 25 discriminates that the writing time number is smaller than the re-processing time number, then it returns the processing to step ST32, but in the other case, the processing section 25 performs an error process.

Step ST35:

The processing section 25 writes file attribute data corresponding to the file data written in the file data area 102 at step ST32 into the file attribute area

120_n illustrated in FIG. 9.

At this time, the processing section 25 calculates an address into which the next file attribute area 120_n is to be written in the memory 35 based on the second address B, the file number data read out from the file number area 111, the size of the file attribute area 120_n and so forth illustrated in FIG. 9.

Step ST36:

The processing section 25 discriminates whether or not the writing at step ST35 results in success. If the processing section 25 discriminates that the writing results in success, then it ends the processing, but if the processing section 25 discriminates that the writing results in failure, then it advances the processing to step ST37.

Step ST37:

The processing section 25 discriminates whether or not the number of times of the writing at step ST35 is smaller than a predetermined re-processing time number. If the processing section 25 discriminates that the writing time number is smaller than the re-processing time number, then it returns the processing to step ST25, but in the other case, the processing section 25 performs an error process.

As described above, according to the writing apparatus 11, when file data and so forth are to be written into the radio tag 10 which has the rewriting inhibiting function, the radio tag 10 is set to a writing inhibiting state. Consequently, it is possible to prevent file data and so forth from being illegally written into the radio tag 10 by a third party.

Further, according to the writing apparatus 11, when file data and so forth are to be written into the radio tag 10a which does not have the rewriting inhibiting function, signature data for the file data and so forth are further written into the radio tag 10a.

Consequently, the terminal apparatus 15 can verify the validity of the file data based on the signature data recorded in the radio tag 10a. Therefore, it is possible to prevent file data and so forth written illegally in the radio tag 10a by a third party from being utilized as valid data and for forth.

On the other hand, according to the data distribution system 1, sets of file name data and file data of a variable size are written in order from the first address toward the second address illustrated in FIG. 9, and file attributed data of a fixed size corresponding to the sets are recorded in order from the

second address toward the first address.

Therefore, the recording area of the memory 35 of the radio tag 10 or 10a can always be utilized efficiently without being influenced by the undefined variable size of the file data and so forth. Consequently, the data amount of the file data which can be recorded into the memory 35 of the radio tag 10 or 10a can be made great.

Further, since the file attribute data are recorded beginning with the second address B toward the first address A and besides have a fixed size, the terminal apparatus 15 which is hereinafter described can specify the address of the file attribute data by a simple process based on the second address B and the fixed size of file attribute data without using a complicated file system adopted in a computer and so forth. Further, the terminal apparatus 15 can specify the address of the file data by a simple process based on the thus specified file attribute data.

Therefore, according to the data distribution system 1, the processing amount involved in file management and the data amount necessary for the processing can be reduced when compared with those by a conventional data distribution system.

Further, in the embodiment described hereinabove, since the file name area 141 shown in FIGS. 5 to 8 has a variable size, it can cope readily with unique file name data defined individually by a plurality of terminal apparatus 15.

Further, according to the data distribution system 1, where the writing apparatus 11 compresses file data and writes the compressed file data into the memory 35 of the radio tag 10 or 10a, the terminal apparatus 15 can read out the compressed file data in a short period of time from the memory 35.

[Terminal apparatus 15]

The terminal apparatus 15 reads out data written in the memory 35 of the radio tag 10 or 10a in the format described hereinabove with reference to FIGS. 4 to 10.

In particular, the terminal apparatus 15 reads out file data, file attribute data and so forth from the radio tag 10.

On the other hand, from the radio tag 10a, the terminal apparatus 15 reads out signature data in addition to file data and file attribute data. After the terminal apparatus 15 verifies the validity of the signature data, it utilizes the file data, file attribute data and so forth read out as described above as valid

data.

Since the radio tag 10a does not have the writing inhibiting function, a third party can write file data illegally into the radio tag 10a. However, since the terminal apparatus 15 performs verification of signature data, it can appropriately detect such illegally written file data as described above. Consequently, utilization of the illegal file data in error can be prevented.

In the reading gout operation described above, the terminal apparatus 15 reads out the file attribute data of a fixed size recorded in the file attribute areas 120_n illustrated in FIG. 9 of the memory 35 of the radio tag 10 or 10a based on the fixed size, the second address B illustrated in FIG. 9 and so forth.

Then, the terminal apparatus 15 reads out file data or compressed filed data recorded in the file data area 102 based on addresses defined in the file attribute data read out as above.

Consequently, the terminal apparatus 15 can specify the address at which the file attribute data are recorded in the recording area of the memory 35 without being influenced by file data of a variable size and so forth.

Further, the addresses at which the file data and so forth are recorded in the recording area can be

specified from the addresses which form the file attribute data recorded in the file position designation area 121 illustrated in FIG. 10.

FIG. 16 shows a hardware configuration of the terminal apparatus 15 shown in FIG. 1.

Referring to FIG. 16, the terminal apparatus 15 includes a display unit 41, an RF section 42, an antenna 43, a memory 44, a processing section 45 and a signature verification section 46 connected to each other by a data line 40.

The display unit 41 displays an image (for example, an advertisement image) according to file data recorded in the radio tag 10a based on a display signal from the processing section 45.

The RF section 42 transfers data by radio to and from the radio tag 10 or 10a through the antenna 43.

The memory 44 is used to record the program PRG2 which defines a process of the processing section 45 and various data used in the process of the processing section 45.

The processing section 45 generally controls the process of a terminal apparatus 16 hereinabove or hereinafter described based on the program PRG2.

The signature verification section 46 verifies the

validity of signature data read out from the signature area 143 illustrated in FIG. 6 or 8 of the radio tag 10a using public key data of the writing apparatus 11.

In the following, an example of reading out operation from the radio tag 10 or 10a by the terminal apparatus 15 is described.

FIG. 17 illustrates an example of a general reading out operation from the radio tag 10 or 10a by the terminal apparatus 15 shown in FIGS. 1 and 16.

It is to be noted that, in the following operation example, the processing section 45 of the terminal apparatus 15 shown in FIG. 16 reads out data from the memory 35 of the radio tag 10 or 10a through the RF section 42 and the memory 44.

Further, the processing section 45 issues a reading out instruction to the memory accessing section 34 of the radio tag 10 or 10a.

Step ST41:

If the processing section 25 of the writing apparatus 11 receives an input of a writing instruction from the computer 12 through the interface 21, then it reads out data representative of whether or not the writing inhibiting function exists in tag data from the memory 35 of the radio tag 10 or 10a through the RF

section 22 and the antenna 23.

Step ST42:

The processing section 45 discriminates based on the data read out at step ST41 whether or not the radio tag 10 or 10a has the writing inhibiting function. If the processing section 45 discriminates that the radio tag 10 or 10a has the writing inhibiting function, then it advances its processing to step ST43, but in the other case, the processing section 45 advances the processing to step ST45.

More particularly, when the writing apparatus 11 is to perform reading out from the radio tag 10, then the processing advances to step ST43, but if reading out from the radio tag 10a is to be performed, then the processing advances to step ST45.

Step ST43:

The processing section 45 reads out file data or compressed file data from the file area 142 illustrated in FIG. 5 or the compressed file area 153 illustrated in FIG. 7 of the memory 35 of the radio tag 10.

The reading out operation is hereinafter described in detail.

Step ST44:

The processing section 45 discriminates whether or

not the reading out at step ST43 results in success. If the processing section 45 discriminates that the reading out results in success, then it ends the processing, but in the other case, the processing section 45 executes an error process.

Step ST45:

The processing section 45 reads out the file data, file attribute data and so forth from the memory 35 of the radio tag 10a. The reading out operation is hereinafter described in detail.

Further, the processing section 45 reads out signature data from the signature area 143 illustrated in FIG. 6 or 8 of the memory 35 of the radio tag 10a.

Step ST46:

The processing section 45 issues a signature verification instruction to the signature verification section 46.

The signature verification section 46 verifies the validity of the signature data read out at step ST45 using the public key data of the writing apparatus 11 in accordance with the signature verification instruction.

Step ST47:

The processing section 45 discriminated whether or not a condition that the reading out at step ST45 results

in success and another condition that it is discriminated at step ST46 that the signature data is valid. If the processing section 45 discriminates that the conditions are satisfied, then the processing section 45 ends the processing, but in the other case, the processing section 45 performs an error process.

In the following, details of the reading out operation of file data, file attribute data and so forth at steps ST43 and ST45 illustrated in FIG. 17 are described.

FIGS. 18 and 19 illustrate the reading out operation.

Step ST51:

The processing section 45 of the terminal apparatus 15 shown in FIG. 16 receives a reading out instruction together with predetermined file name data, for example, in accordance with execution of the program PRG2.

The processing section 45 discriminates whether or not the file name data is valid. If the processing section 45 discriminates that the file name data is valid, then it advances the processing to step ST52, but in the other case, the processing section 45 performs an error process.

For example, if the processing section 45 receives

a file name to which ".html" is not added as an identifier, then it discriminates that the file name data is not valid.

Step ST52:

The processing section 45 reads out, based on addresses recorded in the file position designation areas 121 of all of the file attribute areas 120_n shown in FIG. 10 in the file table area 103 of the memory 35 of the radio tag 10 or 10a, file name data recorded in the file name area 141 in the file data area 102 shown in FIGS. 4 and 5.

At this time, the processing section 45 specifies the file position designation areas 121 in the file attribute areas 120_n based on the file number indicated by the file number area 111 and the size of the file attribute areas 120_n illustrated in FIG. 9.

Step ST53:

The processing section 45 discriminates whether or not the file name data read at step ST52 include the file name data designated at step ST51. If the processing section 45 discriminates that the file name data include the designated file name data, then it advances the processing to step ST54. However, if the processing section 25 discriminates that the file name data do not

include the designated file name data, then it performs an error process.

Step ST54:

The processing section 45 reads out file attribute data corresponding to the file name data received at step ST51 from the file attribute area 120_n illustrated in FIG. 9 of the memory 35 of the radio tag 10.

Step ST55:

The processing section 45 discriminates whether or not the reading out at step ST54 results in success. If the processing section 45 discriminates that the reading out results in success, then it advances the processing to step ST58, but in the other case, the processing section 45 advances the processing to step ST56.

Step ST56:

The processing section 45 discriminates whether or not the number of times by which the reading out at step ST54 is repeated is smaller than a predetermined re-processing time number. If the processing section 45 discriminates that the number of times is smaller than the predetermined re-processing time number, then the processing section 25 returns the processing to step ST54, but in the other case, the processing section 45 executes an error process.

Step ST58:

The processing section 45 reserves a recording capacity for reading out file data from the radio tag 10 or 10a in a buffer memory which forms part of the memory 44 illustrated in FIG. 16.

Step ST59:

The processing section 45 discriminates whether or not the recording capacity is reserved successfully in the buffer memory at step ST58. If the processing section 45 discriminates that the recording capacity is reserved, then it advances the processing to step ST60, but in the other case, the processing section 45 performs an error process.

Step ST60:

The processing section 45 reads out the file data from the address in the file data area 102 read out from the file position designation area 121 illustrated in FIG. 10 based on the file attribute data read out at step ST54 and records the file data into the memory 44.

Step ST61:

The processing section 45 discriminates whether or not the reading out at step ST60 results in success. If the processing section 45 discriminates that the reading out results in success, then it advances the processing

to step ST63, but in the other case, the processing section 45 advances the processing to step ST62.

Step ST62:

The processing section 45 discriminates whether or not the number of times by which the reading out at step ST60 is repeated is smaller than a predetermined re-processing time number. If the processing section 45 discriminates that the number of times is smaller than the predetermined re-processing time number, then it returns the processing to step ST60, but in the other case, the processing section 45 executes an error process.

Step ST63:

The processing section 45 discriminates whether or not the file data read out from the memory 35 of the radio tag 10 at step ST60 are compressed file data. If the processing section 45 discriminates that the read out file data are compressed file data, then it advances the processing to step ST64, but in the other case, the processing section 45 ends the processing. Thereafter, the processing section 45 reproduces the file data read out from the memory 44 in accordance with an instruction from the user and causes the display unit 41 to display an image based on the reproduced file data.

Step ST64:

The processing section 45 decompresses the compressed data read out at steps ST60 using a decompression method corresponding to a compression method indicated by a compression type read out from the compression type area 152 illustrated in FIGS. 7 and 8 together with the compressed file data at step ST60.

Step ST65:

The processing section 45 discriminates whether or not the decompression process at step ST64 results in success. If the processing section 45 discriminates that the decompression process results in success, then it ends the processing, but in the other case, the processing section 45 performs an error process.

As described above, according to the terminal apparatus 15, when file data and so forth are to be read out from the radio tag 10, since the radio tag 10 has the writing inhibiting function, the file data and so forth read out in this manner can be utilized with reliability.

Further, according to the terminal apparatus 15, when file data and so forth are to be read out from the radio tag 10a, the validity of the file data can be verified based on signature data recorded in the radio tag 10a. Consequently, it can be prevented to utilize file data and so forth written illegally into the radio

tag 10a by a third party as legal file data and so forth in error.

Further, according to the data distribution system 1, in the memory 35 of the radio tag 10, file attribute data are recorded from the second address B side toward the first address A and besides have a fixed size.

Therefore, the terminal apparatus 15 can specify the address of the file attribute data by a simple process based on the second address B and the fixed size of file attribute data without using a complicated file system which is adopted in a computer and so forth. Further, the terminal apparatus 15 can specify the address of the file data by a simple process based on the thus specified file attribute data. Consequently, the processing amount of the terminal apparatus 15 involved in data reading out from the memory 35 can be reduced.

Further, according to the terminal apparatus 15, after file data are read out from the memory 35, file attribute data corresponding to the file data are read out. Consequently, even if the reading out of file data fails midway, since the file attribute data are not read out as yet, the file data can be prevented from being processed inappropriately based on the file attribute data.

Further, according to the terminal apparatus 15, even where file name data to be used in request for reading out is defined as a shortcut in the memory 35 of the radio tag 10 or 10a, corresponding data can be read out appropriately.

The present invention is not limited to the embodiment described above.

For example, while, in the embodiment described above, the recording data are HTML file data, the recording data may otherwise be data different from HTML file data.

Further, while, in the embodiment described above, data transfer between the writing apparatus 11 and terminal apparatus 15 and the radio tag 10 or 10a is performed by radio communication, the data transfer may otherwise be performed by wire communication.

Further, while, in the embodiment described above, the recording medium into and from which writing and reading out are performed by the writing apparatus 11 and the terminal apparatus 15 is the memory 35 of the radio tag 10 or 10a, the present invention may be applied also to writing into and reading out from any other memory which is used in computers and communication apparatus.

Furthermore, while, in the embodiment described

above, the first address A is defined on the top address side in the memory 35 of the radio tag 10 or 10a illustrated in FIG. 9 while the second address B is defined on the tail address side in the memory 35, alternatively the second address B may be defined on the top address side in the memory 35 while the first address A is defined on the tail address side.

Industrial Applicability

The present invention can be applied to a system wherein recording data are written into and read out from a recording medium which has a writing inhibiting function and another recording medium which does not have the writing inhibiting function.

CLAIMS

1. A data processing apparatus for writing recording data into a recording medium (10, 10a), characterized in that said data processing apparatus (11) comprises:

a signature production means (26) for producing signature data for the recording data; and

a writing means (25) for discriminating whether or not the recording medium (10, 10a) has a writing inhibiting function and performing, when it is discriminated that the recording medium (10) has the writing inhibiting function, a first operation of writing the recording data into the recording medium (10) but performing, when it is discriminated that the recording medium (10a) does not have the writing inhibiting function, a second operation of writing the signature data produced by said signature production means (26) and the recording data into the recording medium (10a).

2. The data processing apparatus according to claim 1, characterized in that said writing means (25) places the recording medium (10) into a writing inhibiting state after said writing means (25) records the recording data on the recording medium (10) in the first operation.

3. The data processing apparatus according to claims 1 or 2, characterized in that said writing means (25) writes, in each of the first and second operations thereof, a plurality of recording data of a variable size in order beginning with a first address (A) toward a second address (B) of a recording area of the recording medium (10, 10a) and records a plurality of attribute data of a fixed size individually defined corresponding to the plurality of recording data and indicating recording addresses in the recording area for the corresponding recording data in order from the second address (B) side toward the first address (A).

4. The data processing apparatus according to claim 3, characterized in that said writing means (25) writes the plurality of recording data in order at the successive addresses in the recording area of the recording medium (10, 10a), and the recording medium (10, 10a) is of the type wherein erasure of recording data written therein is performed by collective erasure for the overall recording area.

5. A data processing method, characterized in that said data processing method comprises:

a first step of discriminating whether or not a recording medium (10, 10a) has a writing inhibiting

function;

a second step of writing, when it is discriminated at the first step that the recording medium (10) has the writing inhibiting function, recording data into the recording medium (10);

a third step of producing, when it is discriminated at the first step that the recording medium (10a) does not have the writing inhibiting function, signature data for the recording data; and

a fourth step of writing the signature data produced at the third step and the recording data into the recording medium (10a).

6. The data processing method according to claim 5, characterized in that, at each of the second and fourth steps, a plurality of recording data of a variable size in order beginning with a first address (A) toward a second address (B) of a recording area of the recording medium (10, 10a) and records a plurality of attribute data of a fixed size individually defined corresponding to the plurality of recording data and indicating recording addresses in the recording area for the corresponding recording data in order from the second address (B) side toward the first address (A).

7. A program for being executed by a data

processing apparatus (11), characterized in that said program causes said data processing apparatus (11) to execute:

- a first procedure of discriminating whether or not a recording medium (10, 10a) has a writing inhibiting function;

- a second procedure of writing, when it is discriminated at the first procedure that the recording medium (10) has the writing inhibiting function, recording data into the recording medium (10);

- a third procedure of producing, when it is discriminated at the first procedure that the recording medium (10a) does not have the writing inhibiting function, signature data for the recording data; and

- a fourth procedure of writing the signature data produced at the third procedure and the recording data into the recording medium (10a).

8. A data processing apparatus for reading out recording data from a recording medium (10, 10a), characterized in that said data processing apparatus (15) comprises:

- a signature verification means (46) for verifying signature data for the recording data; and

- a reading out means (45) for discriminating whether

or not the recording medium (10, 10a) has a writing inhibiting function and performing, when it is discriminated that the recording medium (10) has the writing inhibiting function, a first operation of reading out the recording data from the recording medium (10) and utilizing the recording data but performing, when it is discriminated that the recording medium (10a) does not have the writing inhibiting function, a second operation of reading out the recording data from the recording medium (10a), causing said signature verification means (46) to verify signature data included in the reading data read out from the recording medium (10a) and utilizing the recording data read out from the recording medium (10a) if a condition that said signature verification means (46) discriminates that the signature data is valid is satisfied.

9. The data processing apparatus according to claim 8, characterized in that, where, from the recording medium (10, 10a) on which a plurality of recording data of a variable size are recorded in order beginning with a first address (A) toward a second address (B) of a recording area and a plurality of attribute data of a fixed size individually defined corresponding to the plurality of recording data and indicating recording

addresses in the recording area for the corresponding recording data are recorded in order from the second address (B) side toward the first address (A), the recorded data are to be read out, said reading out means (45) reads out the attribute data of an object of a reading out request based on the second address (B) and the fixed size from the recording area and then reads out the recording data of an object of the reading out request based on the recording address indicated by the read out attribute data from the recording area.

10. A data processing method for reading out recording data from a recording medium (10, 10a), characterized in that said data processing method comprises:

a first step of discriminating whether or not the recording medium (10, 10a) has a writing inhibiting function;

a second step of reading out, when it is discriminated at the first step that the recording medium (10) has the writing inhibiting function, the recording data from the recording medium (10) and utilizing the recording data;

a third step of reading out, when it is discriminated at the first step that the recording medium

(10a) does not have the writing inhibiting function, the recording data from the recording medium (10a) and verifying signature data included in the reading data read out from the recording medium (10a); and

a fourth step of utilizing the recording data read out from the recording medium (10a) if a condition that it is discriminated at the third step that the signature data is valid is satisfied.

11. A program for being executed by a data processing apparatus (15), characterized in that said program causes said data processing apparatus (15) to execute:

a first procedure of discriminating whether or not the recording medium (10, 10a) has a writing inhibiting function;

a second procedure of reading out, when it is discriminated at the first procedure that the recording medium (10) has the writing inhibiting function, the recording data from the recording medium (10) and utilizing the recording data;

a third procedure of reading out, when it is discriminated at the first procedure that the recording medium (10a) does not have the writing inhibiting function, the recording data from the recording medium

(10a) and verifying signature data included in the reading data read out from the recording medium (10a); and

a fourth procedure of utilizing the recording data read out from the recording medium (10a) if a condition that it is discriminated at the third procedure that the signature data is valid is satisfied.