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DESCRIPTION



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ENTERTAINMENT SYSTEM, INFORMATION PROCESSING UNIT AND PORTABLE STORAGE DEVICE

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TECHNICAL FIELD

The present invention relates to an entertainment system, an information processing unit used therefor, and
10 a portable storage device detachably mounted to the information processing unit.

BACKGROUND ART

In an entertainment system including an information
15 processing unit and a memory card detachably mounted to the unit, the memory card serves as an external storage device for the information processing unit. The memory card includes a flash ROM, a control circuit, a clock generating circuit, and a connection terminal. When the memory card
20 is connected to the information processing unit, the memory card communicates with the information processing unit through the connection terminal. The control circuit executes communication control and reading and writing control from/to the flash ROM. The control circuit is formed
25 of a gate array. Power for operating the memory card is supplied from the information processing unit through the

connection terminal.

The memory card stores information in the flash ROM on a file basis. In a particular region of the memory card, there is provided a file management system for managing the files. The file management system manages the use condition of the flash ROM such that addresses in the flash ROM and files stored in the flash ROM correspond. The file management system is stored in a particular region on the flash ROM.

The file management system is first loaded onto the memory of the main body of the information processing unit from the flash ROM so that the information processing unit can access the memory card. Then, referring to information in the loaded file management system, an address of a file to be accessed or of an empty region is obtained. When the information processing unit access the flash ROM, the information processing unit directly specifies the address and reading and writing is performed from/to the address. When the information processing unit updates or deletes a file on the flash ROM, the state of the flash ROM changes. At this time, the information processing unit updates the file management system loaded to the main body of the information processing unit. Then, the contents of the updated new file management system is written back to the memory card.

Note, however, it takes a longer period for the

information processing unit to read/write from/to the flash ROM than to access the memory of the main body of the information processing unit. Therefore, if reading and writing must often be executed from/to the flash ROM, the processing speed of the entire entertainment system itself is lowered. As a result, once the file management system has been loaded into the information processing unit, the file management system is not reloaded unless the state of the flash ROM changes. This prevents the processing speed from unnecessarily being lowered.

DISCLOSURE OF THE INVENTION

Here, there is a problem associated with insertion/extraction of the memory card. The entertainment system allows the memory card to be inserted/extracted as desired, while the power supply for the information processing unit is on. This is for the convenience of the user. The file management system however is peculiar to each memory card. For example, assuming that a file management system is loaded to the main body of an information processing unit from a memory card, and then the memory card is replaced with another memory card. The file management system loaded is not a file management system for the inserted memory card. At this time, when the flash ROM of the memory card is accessed based on information in the loaded file management system, the contents of data may be contradictory, or the contents

of the flash ROM could be destroyed.

Therefore, the information processing unit must know insertion/extraction of the memory card. One method therefor is to provide a switch at a connector portion of the information processing unit. More specifically, the switch is adapted to output an on/off signal when the memory card is inserted/extracted. When these signals are transmitted to a CPU by an interrupt, the information processing unit can be informed of the insertion/extraction of the memory card in real time. In this case, however, such a switch must be separately provided. This increases the number of parts, which pushes up the cost.

The CPU may monitor the insertion/extraction of the memory card for every fixed time period. However, the insertion/extraction of the memory card does not occur very often in normal use. Therefore, the time spent by the CPU for monitoring could be mostly wasted. As a result, the processing efficiency of the entire entertainment system is lowered.

It is an object of the present invention to provide an information processing unit which can be kept informed of the insertion/extraction of a portable storage device without any special parts having a special mechanism, and without increasing the processing load of the information processing unit and a portable storage device detachable to the information processing unit.

In order to achieve the above-described object, there is provided an entertainment system according to a first aspect of the present invention including a portable storage device, and an information processing unit to which the portable storage device is detachably mounted,

the portable storage device including:

a first storage unit whose storage contents are held when the portable storage device is disconnected from the information processing unit; and

a second storage unit whose storage contents are not held when the portable storage device is disconnected from the information processing unit,

the information processing unit includes:

setting means for setting to the second storage unit information indicating that the information processing unit and the portable storage device are connected;

determination means for referring to the second storage unit and determining whether the referred information coincides with the information set by the setting means; and

means for accessing the first storage means.

According to a second aspect of the present invention, there is provided a portable storage device detachable to an information processing unit and including:

a first storage unit whose storage contents are held when disconnected from the information processing unit;

a second storage unit whose set storage contents are held when connected to the information processing unit, the set storage contents are not held when disconnected from the information processing unit; and

5 a control circuit responsive to instructions sent from the information processing unit for controlling reading and writing information from/to the first storage unit and the second storage unit.

10 According to a third aspect of the present invention, there is provided an information processing unit, to which a portable storage device having a non-volatile storage region and a volatile storage region is detachably connected,

the information processing unit including:

means for accessing the non-volatile storage region;

15 reading means for reading particular information stored in the non-volatile storage region of the portable storage device;

20 setting means for setting information to establish identity to the volatile region of the portable storage device when the information processing unit and the portable storage device are connected; and

25 determination means for referring to the information to establish the identity set to the volatile storage region and determining whether the referred information coincides with the information set by the setting means,

the determination means to instruct the reading means

to re-read the particular information when the referred information and the set information do not coincide.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Fig. 1 is an overview of an information processing unit and a memory card according to the present invention;

 Fig. 2 is a diagram showing a hardware arrangement of an information processing unit and a memory card according to the present invention;

10 Fig. 3 is a functional block diagram of a main controller in an information processing unit according to the present invention;

 Fig. 4 is a functional block diagram of a control circuit in information processing unit according to the present invention;

15 Fig. 5 is a diagram illustrating a method of communication between an information processing unit and a memory card according to the present invention; and

 Fig. 6 is a diagram illustrating the process of
20 accessing a memory card by an information processing unit according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

 An embodiment of the present invention will be now
25 described in conjunction with the accompanying drawings. In the following description of the embodiment, an

information processing unit capable of gaming, reproducing images, reproducing sounds, communication and the like, and a memory card detachably mountable to the information processing unit will be described by way of illustration.

5 Note that when a game is played in the information processing unit, and the game is interrupted for example, the process of manipulation until the interruption is written to the memory card, and stored as data. When the game is resumed, the data about the process of manipulation can be
10 used to resume the game from the point of interruption.

 Fig. 1 is an overview of a memory card 100 and an information processing unit 200 according to the present embodiment. The memory card 100 is inserted to a memory card insertion hole 250 at the front of the information processing
15 unit 200. In addition, a controller and a TV monitor (both not shown) are connected to the information processing unit 200 to form together an entertainment system 10. The controller is connected by inserting a cable and a plug connected thereto (both not shown) to a connector insertion
20 hole 260.

 Fig. 2 is a diagram of a hardware arrangement of the memory card 100 and the information processing unit 200 according to the present embodiment.

 The memory card 100 includes a connection terminal
25 110, a control circuit 120, a clock generating circuit 130, a flash ROM 140, and a housing 150 storing these. (see Fig.

1).

The connection terminal 110 comes into contact with a connection terminal 210 of the information processing unit 200 when the memory card 100 is inserted to the memory card insertion hole 250 of the information processing unit 200. As a result, the information processing unit 200 and the memory card 100 are electrically joined.

The control circuit 120 is for example formed of a gate array. One of a gate circuit in the array is used as a register 121. The clock generating circuit 130 generates a clock signal to allow the memory card to operate. Information transmitted from the information processing unit 200 is stored in a flash ROM 140 on a file basis. The flash ROM 140 is a non-volatile memory. A file management system 141 is stored in a particular region of the flash ROM 140. The file management system 141 includes information related to the use condition of the flash ROM 140. For example, the file management system 141 stores an address in the flash ROM 140 and the name of a file stored at the address in association with each other.

The memory card 100 does not have a power supply and therefore is supplied with power from the information processing unit 200 through the connection terminal 110. As a result, when the memory card 100 is connected to the information processing unit 200, the power supply is turned on and when the card is extracted, the power supply is turned

off. The memory card 100 does not have a power supply back up function. Therefore, when the power supply is turned off, the contents of the control circuit 120 including the register 121 will not be held. In this sense, the control circuit
5 120 is a volatile storage device. Thus, the contents of the register 121 will be changed.

The information processing unit 200 includes at least the connection terminal 210, a power supply circuit 220, a main controller 230, an external storage device 240 and
10 a disc drive device 250. The main controller 230 includes at least a CPU 231, and a main memory 232.

The power supply circuit 220 supplies power to the information processing unit 200 and the memory card 100.

The functional block of the main controller 230 is
15 shown in Fig. 3.

The main controller 230 includes at least a memory card management unit 300 which manages the memory card, and an application function (hereinafter referred to as the "AP")
400 implemented by executing an application program. The
20 memory card management unit 300 receives a request from the AP 400 and manages the input/output of the memory card 100. The AP 400 issues a request for reading and writing on a file basis to the memory card management unit 300.

The memory card management unit 300 further includes
25 a command generating unit 301, a communication control unit 302, and a file management system table 303.

The file management system table 303 is formed by loading a file management system 141 of the memory card 100.

The command generating unit 301 receives a request for reading and writing on a file basis from the AP 400 and issues a command to access the memory card. The command generating unit 301 refers to the file management system table 303 as necessary to obtain an address or the like.

The communication control unit 302 controls communication with the memory card 100.

The functional block of the control circuit 120 is shown in Fig. 4.

The control circuit 120 includes at least a communication control unit 501, a command analysis unit 502, a buffer 503, and a reading and writing control unit 504.

The communication control unit 501 receives a command from the information processing unit 200 and outputs a result of process. The command analysis unit 502 analyzes the received command. The command analysis unit 502 then outputs to the reading and writing control unit 504 instructions of reading and writing from/to the flash ROM 140. The command analysis unit 502 writes and refers to the register 121. The buffer 503 temporarily stores the contents of data to be read/written. The reading and writing control unit 504 controls reading and writing data from/to the flash ROM 140.

According to this embodiment, the control circuit 120 is formed of a gate array. Therefore, the

above-described functions are all implemented by hardware logics. However, a memory circuit may be provided with a microcomputer to achieve the functions by software.

An operation of the memory card 100 and the information processing unit 200 as described above will be now described.

When the memory card 100 is inserted to the information processing unit 200, the connection terminals 110 and 210 are coupled with each other. This turns on the power supply of the memory card 100. When the power supply of memory card 100 is turned on, the control circuit 120 is reset. At this time, the register 121 in the control circuit 120 is also reset. More specifically, the register 121 is set to a prescribed initial value.

A process of generating and analyzing a command will be now described in conjunction with Fig. 5.

The AP 400 issues an access request for writing, reading and erasure or the like to and from the memory card 100. Upon receipt of the request, the command generating unit 301 generates a command to be transmitted to the memory card 100 (S110, S120). At this time, the file management system table 303 is referred as necessary to obtain an address. The generated command is sent to the memory card 100 through the communication control unit 302 (S130).

In the memory card 100, the command is received by the communication control unit 501 (S210). The contents of the received command are analyzed by the command analysis

unit 502 (S220). Based on the result of analysis, the reading and writing control unit 504 executes accumulation of data in the buffer 503 or accessing process to the flash ROM 140 (S230). After completion of the process, the
5 communication control unit 501 returns a notification of the completion of the process to the information processing unit 200 (S240).

The process from issuance of an accessing request to the memory card 100 from the AP 400 to execution of the
10 accessing will be now described in conjunction with Fig. 6. Note that in this process, the processes of generating, analyzing, and executing a command are as described above and therefore descriptions are not provided.

The information processing unit 200 checks if the
15 memory card 100 is connected (S310). Here, as a method of checking the connection, a reset command is issued, and determination is made based on the presence/absence of a response. However, the connection does not have to be checked by the above method using the reset command. More
20 specifically, an arbitrary command may be issued to the memory card 100, and it may be determined that the memory card 100 is not connected when there is no response in a prescribed time period.

When the connection of the memory card 100 is confirmed,
25 the information processing unit 200 writes to the register 121 an authentication value to establish the identity of

the memory card 100 (S320). The authentication value is a particular value different from the initial value.

The information processing unit 200 reads out the file management system 141. The read out file management
5 system 141 is loaded to the file management system table 303 in the information processing unit 200 (S330).

Once the process to S330 has been completed, the memory card management unit 300 will be able to access the memory card 100. The memory card management unit 300 waits for a
10 request from the AP 400 (S140).

When the memory card management unit 300 accepts an access request from the AP 400, the memory card management unit 300 refers to the contents of the register 121 (S350). Then, the referred contents and the authentication value
15 set at S320 are compared to determine when they are identical (S360). When they are not identical, it is determined that the memory card 100 whose the file management system 141 has been loaded into the information processing unit 200 and the presently connected memory card 100 are different.
20 Then, the processes in S320 and S330 are executed, and the file management system 141 is re-loaded to the file management system table 303.

As described above, when the memory card 100 is extracted from the information processing unit 200, the power
25 supply of the memory card 100 is turned off. Therefore, turning off the power supply prevents the contents of the

register 121 from being held, and this characteristic is utilized. Furthermore, when the memory card 100 is inserted and the power supply is turned on, the contents of the register 121 are initialized, so that accidental coincidence is not possible.

After the file management system 141 loaded in the file management system table 303 is confirmed as the system of the memory card 100 presently connected, a command is issued to the memory card 100 based on the contents of the file management table 303 (S370).

When the memory card is updated at S370, the contents of the flash ROM 140 has been changed. As a result, the file management system table 303 is updated and written back to the flash ROM 140 to update the file management system 141 (S180, S190).

In this embodiment, when data in the flash ROM 140 is read out (read) or erased, or data is written (write) in to the flash ROM 140, a set of a plurality of commands, or a command set is used. More specifically, both a reading command set and a writing command set include an address setting command to set an address to be accessed, a transmission/reception command to transmit/receive data, and an execution command to instruct accessing execution. An erasing command set includes the address setting command and the executing command. Each of the commands is sent from the information processing unit 200 to the memory card 100.

The address setting command in each command set specifies an address in the flash ROM 140 at which data is to be subjected to reading, writing or erasure.

In the reading command set, the
5 transmission/reception command has data read out from the flash ROM 140 and received in the information processing unit 20. In the writing command set, the transmission/reception command transmits data to be written into the flash ROM 140 to the memory card 100. The data
10 transmitted to the memory card 100 is temporarily stored in the buffer 503.

The following processes are executed by the execution command.

For the writing command set, data held in buffer 503
15 is written into the flash ROM 140 by the execution command, and the contents of the flash ROM 140 is updated. For the reading command set, data read from the flash ROM 140 is completed. For erasing command set, data in a prescribed region of the flash ROM 140 is erased. More specifically,
20 a series of processes of reading, writing and erasure are each completed by the execution command.

Here, in the memory card 100 which has accepted the address setting command, once the process of the address setting command is completed, the memory card 100 issues
25 a completion notification to the information processing unit 200. The information processing unit 200 issues the next

command after receiving this completion notification.
Therefore, the completion notification is indispensable.
So, the completion notification of the address setting
command may include the contents of the register 121. Thus,
5 the process being independently executed at S350 can be
included in the address setting command. As a result, the
number of communication between the information processing
unit 200 and the memory card 100 can be reduced.

At S310, the memory card 100 is reset to confirm the
10 connection of the memory card 100. The resetting is executed
before the start of communication between the memory card
100 and the information processing unit 200, and therefore
S320 and S330 may be included in a part of the resetting
process.

15 As described in the foregoing, according to the
present embodiment, the insertion/extraction of the memory
card can be confirmed using a simple and inexpensive structure
without providing a switch at the memory card insertion hole.
As a result, the number of parts used for the entertainment
20 system can be reduced, which reduces the cost.

Furthermore, data contradiction or memory card
destruction can be prevented without constantly monitoring
the insertion/extraction of the memory card.

According to the present invention, the
25 insertion/extraction of the portable storage device can be
kept informed without any special parts having a special

mechanism and increasing the processing load of the entertainment system.

CLAIMES

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1. An entertainment system comprising a portable storage device, and an information processing unit to which said portable storage device is detachably connected,

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said portable storage device, comprising:

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a first storage unit whose storage contents are held when disconnected from said information processing unit; and

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a second storage unit whose storage contents are not held when disconnected from said information processing unit,

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said information processing unit comprising:

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setting means for setting to said second storage unit information indicating that said information processing unit and said portable storage device are connected;

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determination means for referring to said second storage unit and determining whether said referred information coincides with the information set by said setting means; and

16

means for accessing said first storage unit.

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2. An entertainment system according to claim 1, wherein:

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said first storage unit has a plurality of storage regions, and holds storage unit information containing storage contents identification information to show what kind of information is held in each of storage regions and information related to an

7 address where information specified by said storage contents
8 identification information is stored;

9 said information processing unit further comprises
10 reading means for reading said storage unit information; and

11 said reading means reads said storage unit information
12 when the result of determination by said determination means
13 does not indicate a coincidence.

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1 3. An entertainment system according to claim 2, wherein

2 said accessing means refers to or updates the contents
3 of information stored in said first storage unit based on said
4 storage unit information read by said reading means, and

5 said determination means makes said determination before
6 said accessing means refers to or updates the contents of
7 information stored in said first storage unit.

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1 4. An entertainment system according to any one of claims
2 1 to 3, wherein

3 said information processing unit further comprising
4 initialization means for initializing said second storage unit
5 when said portable storage device is connected to the information
6 processing unit.

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1 5. A portable storage device detachable to an
2 information processing unit, comprising:

3 a first storage unit whose storage contents are held when

4 disconnected from said information processing unit;

5 a second storage unit whose written storage contents are
6 held when connected to said information processing unit, said
7 written storage contents not being held when disconnected with
8 said information processing unit; and

9 a control circuit responsive to instructions sent from
10 said information processing unit for controlling reading and
11 writing information from and to said first storage unit and said
12 second storage unit.

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1 6. A portable storage device according to claim 5,
2 wherein

3 said first storage unit has a plurality of storage regions,
4 and holds storage unit information containing storage contents
5 identification information to show what kind of information is
6 held in each of storage regions and information related to an
7 address where information specified by said storage contents
8 identification information is stored and

9 when the portable storage device is connected with said
10 information processing unit, said storage unit information can
11 be referred to by the information processing unit.

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1 7. A portable storage device according to claim 6,
2 wherein:

3 said first storage unit is non-volatile; and
4 said second storage unit is volatile.

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1 8. A portable storage device according to claim 6,
2 wherein:

3 said first storage unit is formed of a flash ROM; and
4 said second storage unit is formed of a gate circuit.

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1 9. A portable storage device detachable to an
2 information processing unit, comprising:

3 a first storage unit whose storage contents are held when
4 disconnected from said information processing unit;

5 a second storage unit whose written storage contents are
6 held when connected to said information processing unit, said
7 written storage contents being not held when disconnected from
8 said information processing unit, said second storage unit
9 comprising a region to store information indicating that said
10 information processing unit and the portable storage device are
11 connected;

12 communication control means for receiving a command from
13 said information processing unit and notifying said information
14 processing unit of the result of process the command; and

15 control means for controlling reading and writing from
16 and to said first storage unit based on the command received
17 by said communication control means,

18 when the command received by said communication control
19 means is an address setting command to set an address to be accessed,
20 said control means executing an addressing process based on the
21 address setting command,

22 once said addressing process is completed, said
23 communication control means notifying said information
24 processing unit of the storage contents of said region to store
25 information indicating the connection state of the information
26 processing unit and the portable storage device as a completion
27 notification of said address setting command.

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1 10. An information processing unit to which a portable
2 storage device having a non-volatile region and a volatile region
3 is detachably connected, comprising:

4 means for accessing said non-volatile storage region;

5 setting means for setting information to establish
6 identity to the volatile region of said portable storage device
7 when the information processing unit and said portable storage
8 device are connected; and

9 determination means for referring to said information
10 to establish identity set to said volatile storage region and
11 determining whether said referred information coincides with
12 the information set by said setting means,

13 said accessing means reading out particular information
14 stored in said non-volatile storage region,

15 said determination means instructing said accessing
16 means to re-read said particular information when said referred
17 information and the set information do not coincide.

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1 11. An information processing unit according to claim

2 10 further comprising,
3 initializing means for initializing said volatile
4 storage region when said portable storage device is connected
5 to the information processing unit.