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(71) Applicant(s):
Hewlett-Packard Development Company
L.P., 20555 S.H.249, Houston, Texas 77070,
United States of America

(72) Inventor(s):
Alexandre P V Delorme
David H Hanes

(74) Agent and/or Address for Service:
EIP
Fairfax House, 15 Fulwood Place,
LONDON, WC1V 6HU, United Kingdom

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WO 2004/047111 A1 JP 2004094494 A
US 6389500 B1 US 5721838 A
US 20050086433 A1 US 20040236980 A1
Western Digital - WD Dual-Option External USB Hard Drive - Quick Install Guide Retrieved from http://www.wdc.com/en/library/dual-option/2079-001049.pdf - PDF first created 27/5/2004

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(54) Abstract Title: **External storage device with user activated disconnect request component.**

(57) An external storage device has a user activated component to transmit a disconnect request to an attached computer. The component may be physically or electronically activated. The component may be a switch or button on the housing of the storage device. Alternatively it may be a touch or temperature pad. The external storage device may be an external hard drive. The component on activation may initiate a software routine to allow safe removal of the external device. The host computer may be configured to copy files to the external device if the file had been previously copied from the external device. The computer may also be configured to copy files from the host to the device if they do not match. The computer may also be configured to finish any data operation before the connection between the device and computer is severed.

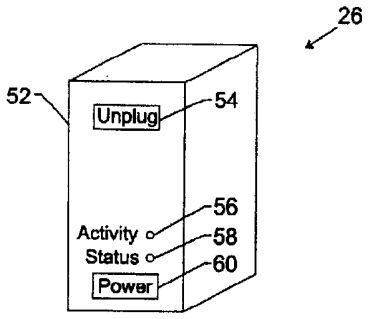

FIG. 2

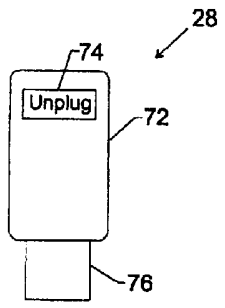

FIG. 3

GB 2 425 379 A

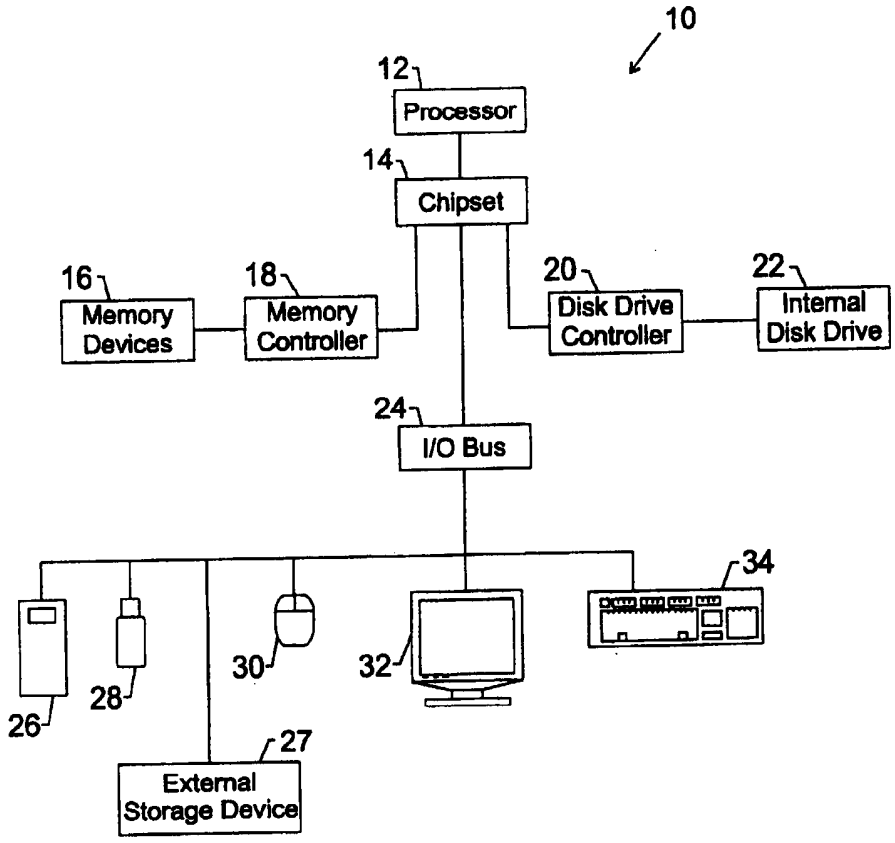
10
12
Processor
14
Chipset
16
Memory Devices
18
Memory Controller
20
Disk Drive Controller
22
Internal Disk Drive
24
I/O Bus
26
28
30
32
34
27
External Storage Device

FIG. 1

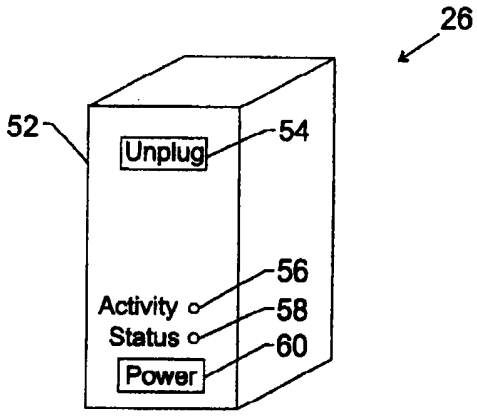
26
52
Unplug
54
56
Activity
58
Status
60
Power

FIG. 2

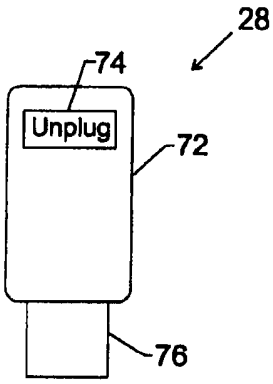
28
74
Unplug
72
76

FIG. 3

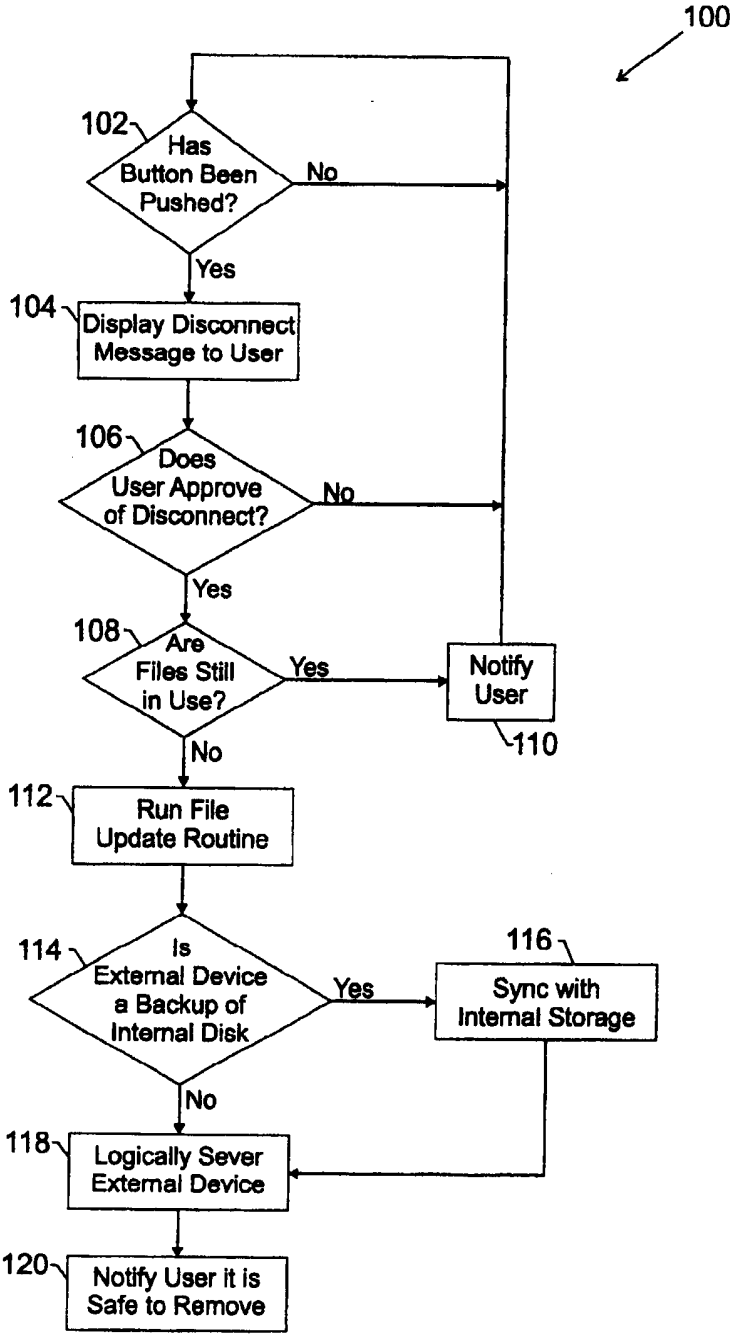
100
102
Has Button Been Pushed?
No
Yes
104
Display Disconnect Message to User
106
Does User Approve of Disconnect?
No
Yes
108
Are Files Still in Use?
Yes
Notify User
110
No
112
Run File Update Routine
114
Is External Device a Backup of Internal Disk
Yes
116
Sync with Internal Storage
No
118
Logically Sever External Device
120
Notify User it is Safe to Remove

FIG. 4

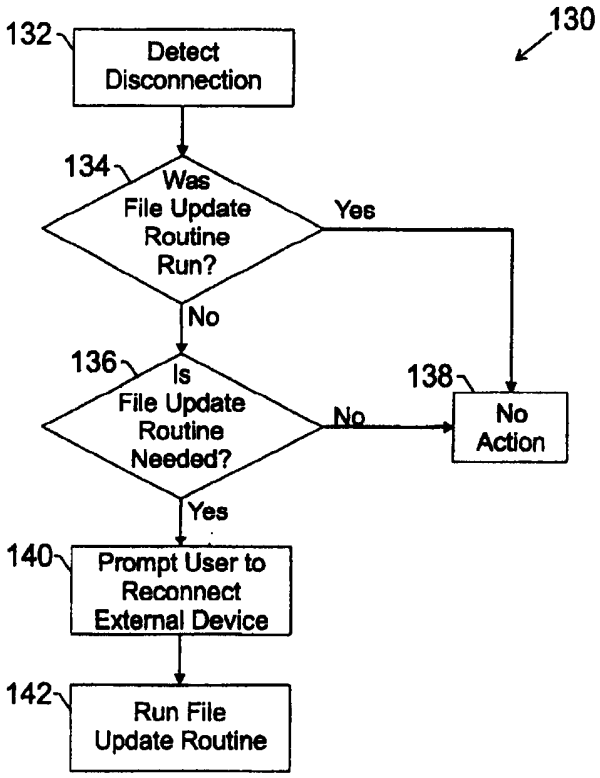
130
132
Detect Disconnection
134
Was File Update Routine Run?
Yes
No
136
Is File Update Routine Needed?
No
138
No Action
Yes
140
Prompt User to Reconnect External Device
142
Run File Update Routine

FIG. 5

METHOD AND APPARATUS FOR DISCONNECTING AN EXTERNAL DATA STORAGE DEVICE FROM A COMPUTER

BACKGROUND

[0001] External data storage devices, such as external hard drives, allow a user to increase the available storage space on a computer without having to physically open a computer case and install a new disk drive. To utilize the external data storage device, the user connects a cable from the external data storage device to a connection point on the computer. Alternatively, a user can establish a wireless link between the external data storage device and the computer via a wireless protocol.

[0002] Modern operating systems implement a complex file management system to control data storage. These complex file management systems often include data caching algorithms that store copies of often used or recently used data files in the computer's memory because the computer's memory can be accessed much faster than disk drives. However, the system memory is smaller than the available storage on the disk drive. When the computer needs memory to store a file, the computer clears space in memory by running a file update routine to update the version of the file stored on the disk drive with the newer version stored in the computer's memory. Once the newest version of the file is stored on the disk drive, the computer can use the memory that was holding that file for another file. Even though the data caching algorithm described above dramatically improves the performance of a computer system, issues arise when external data storage devices are integrated into the computer's file system. These issues stem from the fact that external data storage devices are not permanently attached to the computer and can be easily removed. For instance, an external flash memory drive can be removed from a computer system by merely pulling the flash memory drive from

its port. If a more recent copy of a data file from the external data storage device is stored in the computer system's memory instead of the external data storage device, data can be lost or corrupted if the external data storage device is unexpectedly disconnected from the computer. This loss or corruption of data occurs because there is no way for the operating system to update the data file on the external data storage device once the external data storage device is physically disconnected from the computer. Changes made to the copy of the data file that was being stored in the computer system's memory are lost.

[0003] Realizing that this potential data loss could be a problem, many computer operating systems have attempted to provide solutions that involve software that runs a file update routine to ensure that the most recent copy of the data file has been updated to the external data storage device. However, these file update routines need to be initiated by the user, and some users may not understand how to initiate the removal software.

SUMMARY

[0004] Embodiments of the invention provide methods and apparatuses for disconnecting an external data storage device from a computer. According to a first aspect of the present invention there is provided an external data storage device comprising an activatable component to transmit a request to disconnect the external data storage device from a computer, wherein the activatable component comprises an apparatus capable of being physically or electrically activated.

[0005] According to a second aspect of the present invention there is provided a computer system comprising a computer and an external data storage device configured to send a signal to the computer when a user-activated component located on the external data storage device

is activated, wherein the signal comprises a request to disconnect the external data storage device from the computer.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to further highlight the ways in which it may be brought into effect, embodiments will now be described, by way of example only, with reference to the following drawings in which:-

[0006] Fig. 1 is a block diagram of an exemplary computer system for disconnecting an external data storage device in accordance with embodiments of the invention;

[0007] Fig. 2 is a diagram of an exemplary external hard disk drive in accordance with embodiments of the present invention;

[0008] Fig. 3 is a diagram of an exemplary flash memory drive in accordance with exemplary embodiments of the present invention;

[0009] Fig. 4 is a flow chart illustrating an exemplary process for disconnecting an external data storage device in accordance with embodiments of the invention; and

[0010] Fig. 5 is a flow chart illustrating an exemplary process for preventing data loss due to disconnecting an external data storage device in accordance with embodiments of the invention.

DETAILED DESCRIPTION

[0011] Exemplary embodiments in accordance with the present invention are directed towards an external data storage device, such as an external hard drive or a flash memory drive. The external data storage device includes an activatable component that transmits a request to disconnect the external data storage device. In one embodiment, this activatable component enables a user to remove the external data storage device without the risk of data loss or data corruption.

[0012] Fig. 1 shows a block diagram of an exemplary computer system 10 for disconnecting an external data storage device. In one embodiment, the computer system 10 includes one or more processors or central processing units ("CPUs") 12. The CPU 12 is used individually or in combination with other CPUs. While the CPU 12 will be referred to primarily in the singular, a system with any suitable number of physical or logical CPUs can be implemented.

[0013] A chipset 14 is coupled to the CPU 12. The chipset 14 provides a communication pathway for signals between the CPU 12 and other components of the computer system 10 that includes a memory controller 18, an input/output ("I/O") bus 24, and a disk drive controller 20. Depending on the configuration of the computer system 10, any one of a number of different signals could be transmitted through the chipset 14. The routing of the signals throughout the computer system 10 can be readily adjusted without changing the underlying nature of the computer system 10.

[0014] As shown, the memory controller 18 is operably coupled to the chipset 14. In alternate embodiments, the memory controller 18 is integrated into the chipset 14. The memory controller 18 is operably coupled to one or more memory devices 16. In one embodiment, the memory devices 16 are any one of a number of industry standard memory types, including but not limited to, single inline memory modules ("SIMMs") and dual inline memory modules ("DIMMs"). In certain embodiments of the invention, the memory devices 16 facilitate the safe removal of the external data storage devices by storing both instructions and data.

[0015] The chipset 14 is coupled to the I/O bus 24. The I/O bus 24 serves as a communication pathway for signals from the chipset 14 to I/O devices 26, 27, 28, 30, 32, and 34. The I/O devices 26, 27, 28, 30, 32, and 34 include external data storage devices, such as an external hard disk drive 26, an external data storage device 27, or a flash memory drive 28, as well as user interface devices, such as a mouse 30, a video display 32, or a keyboard 34. The external data storage device 27 may comprise any suitable type of external data storage device, such as a camera, a phone, or a memory card reader, that can be coupled to the computer system 10.

[0016] In one embodiment, the I/O bus 24 employs any one of a number of communications protocols to communicate with the I/O devices 26, 27, 28, 30, 32, and 34. External data storage devices communicate with the computer using an interface protocol. These interface protocols permit the computer to exchange information with the external data storage device. Acceptable communication protocols include, but are not limited to, universal serial bus ("USB"), USB-2, serial advanced technology attachment ("S-ATA"), IEEE-1394, small computer system interface ("SCSI"), integrated drive electronics ("IDE"), fiber channel,

gigabit Ethernet, or Bluetooth®. Various types of communication protocols can be implemented in the computer system 10. In one alternate embodiment, the I/O bus 24 is integrated into the chipset 14.

[0017] In one embodiment, the disk drive controller 20 is operably coupled to the chipset 14. The disk drive controller serves as the communication pathway between the chipset 14 and one or more internal disk drives 22. In certain embodiments of the invention, the internal disk drive 22 facilitates disconnection of the external data storage devices by storing both instructions and data. The disk drive controller 20 and the internal disk drives 22 communicate with each other or with the chipset 14 using any suitable type of communication protocol, including all of those mentioned above with regard to the I/O bus 24.

[0018] Embodiments in accordance with the present invention can be used in a wide variety of computer systems and electronic devices such as, but not limited to, cellular phones, personal computers, personal digital assistants, and other electronic devices that can be coupled to external data storage.

[0019] Fig. 2 shows an exemplary external hard disk drive 26 in accordance with embodiments of the present invention. The external hard disk drive 26 shown in Fig. 2 is a more detailed depiction of the external hard disk drive 26 previously described with regard to Fig. 1. In one embodiment, the external hard disk drive 26 includes a housing or case 52 that includes a disk drive unit (not shown), a power conversion circuit (not shown) to allow the external hard disk drive to be connected to a power source, and a communication protocol circuit (not shown) to permit the external hard disk drive 26 to communicate with the

computer. The power circuitry and the communication circuitry can be located elsewhere without affecting the performance of the external hard disk drive 26.

[0020] The external hard disk drive 26 also includes an activatable component 54. As used herein, an activatable component, such as the activatable component 54, includes, but is not limited to, an actuatable member, a push button, a switch, a touch sensitive pad, a surface that is able to activate when it detects a change in temperature or capacitance that accompanies a human's touch, or various other devices capable of being physically or electrically activated. The activatable component 54 may be located at a variety of suitable locations on the case 52 of the external hard disk drive 26. In one embodiment, when the user activates the activatable component 54, logic or software notifies the computer to which the external hard disk drive 26 is connected that the user wishes to disconnect the external hard disk drive 26. This process will be described in greater detail below in reference to Fig. 4. In one embodiment of the invention, the activatable component 54 has a distinctive color, such as red, to alert the user to its location. In another embodiment, the activatable component 54 flashes to alert the user to its location. In still another embodiment, the activatable component 54 may emit an audible alert to indicate its presence or location to the user.

[0021] In one embodiment, the external hard disk drive 26 also contains an activity light 56 and a status light 58. These lights inform the user about the activity level or status of the disk drive within the case 52. Lastly, the external hard disk drive 26 can contain a power switch 60. The power switch 60 allows the user to turn the external hard disk drive 26 either on or off. In alternate embodiments, the power switch 60 is not present, and power to the external hard disk drive 26 is controlled by manually connecting or disconnecting a power cord (not shown) to a power source.

[0022] Fig. 3 shows a flash memory drive 28 in accordance with exemplary embodiments of the present invention. The exemplary flash memory drive 28 shown in Fig. 3 is a more detailed depiction of the exemplary flash memory drive 28 previously described with regard to Fig. 1. In the illustrated embodiment, the flash memory drive 28 includes a case 72, an activatable component 74, and a connector 76. In one embodiment, the case 72 forms the body of the flash memory drive 28 and the flash memory drive 28 contains some form of solid state memory (not shown). In another embodiment, the case 72 contains a communication circuit (not shown) to permit the flash memory drive 28 to communicate with a computer by USB, USB-2, IEEE 1394, Bluetooth™, or a similar communication protocol.

[0023] In one embodiment, the flash memory drive 28 also includes the connector 76. The connector 76 permits the flash memory drive 28 to physically connect to a computer. The size and shape of the connector 76 will vary based on the communication protocol employed by the flash memory drive 28. For example, if the flash memory drive 28 operates on a USB communication protocol, the connector 76 will be a USB plug. In another embodiment, where the flash memory drive 28 operates on a wireless communication protocol, such as Bluetooth™ or another suitable wireless communication protocol, the connector 76 is absent. In this case, a physical connection between the computer and the flash memory drive is not required, and thus the connector 76 is absent.

[0024] The flash memory drive 28 also includes the activatable component 74. The activatable component 74 is located at a variety of suitable locations on the flash memory drive 28. In one embodiment, when the user activates the activatable component 74, logic or software notifies the computer to which the flash memory drive 28 is connected that the user

wishes to disconnect the flash memory drive 28. This process will be described in greater detail below in reference to Fig. 4. In one embodiment, the activatable component 74 has a distinctive color, such as red, to alert the user to its location. In another embodiment, the activatable component 74 flashes to alert the user to the location of the activatable component 74. In still another embodiment, the activatable component 74 may emit an audible alert to indicate its presence or location to the user.

[0025] Fig. 4 is a flow chart illustrating an exemplary process 100 for disconnecting an external data storage device in accordance with embodiments of the invention. While the process 100 will be described in terms of an unplug button, those skilled in the art will appreciate that another type of activatable component can be substituted for the unplug button. As indicated in block 102, the process 100 begins with a computer waiting for the unplug button to be activated on one of the external data storage devices. After the unplug button has been actuated (e.g., pressed), the external data storage device transmits or sends a disconnect request signal to a CPU or a chipset indicating that the unplug button has been activated. In one embodiment, once the disconnect request signal has been sent, the computer displays a disconnect message to the user on a display, as indicated by block 104. In one embodiment, this disconnect message confirms that the user wants to disconnect the external data storage device. In another embodiment, the computer will execute a software routine embedded within an operating system in response to the disconnection request signal. For example, if the computer is running the Windows® operating system, the computer could run the safely remove hardware software feature. In alternate embodiments, the disconnect message is omitted.

[0026] Once the user confirms the request to unplug the external data storage device (block 106), the computer will determine if one or more of the files stored on the external data

storage device are currently in use by the computer as indicated in block 108. In one embodiment, if the files are still in use, the computer notifies the user, as indicated in block 110, and gives the user the opportunity to close the file that is in use prior to disconnecting the external data storage device. In alternate embodiments, the computer automatically closes the files located on the external data storage device that are currently in use. In this case, the user notification shown in block 110 is not needed.

[0027] Next, per block 112, the computer runs a file update routine on the external data storage device. During the file update routine, the computer prepares the external data storage device to be disconnected from the computer. In one embodiment, this preparation involves checking the files stored on the external data storage device to ensure that changes made to a file that has been copied into the computer memory have been updated back to the copy of the file stored on the external data storage device. In one embodiment, the file update routine also includes the additional steps required to prepare or facilitate the external data storage device to be disconnected from the computer. In one alternate embodiment, the file update routine also includes removing the external data storage device from the computer's file system or adjusting the power to the external data storage device.

[0028] Per block 114, after the computer has run the file update routine (block 112), the computer determines if the external data storage device is functioning as a backup of one of the internal disk drives. In one embodiment, the external data storage devices are used as back-up storage for one of the internal disk drives. If the external data storage device is being used as a backup for one of the internal disk drives, the computer synchronizes pre-designated files stored on the internal disk drive with the external data storage device, as indicated in block 116. This synchronization process can take many forms and is well know to those

skilled in the art. In alternate embodiments of the invention, the synchronization process takes place at some other point within the process 100.

[0029] Regardless of whether the external data storage device is being used as a backup, the computer logically severs the external data storage device from the computer if the external data storage device was not previously logically severed. In one embodiment, logically severing the external storage device comprises removing the external data storage device from a computer's file system, as indicated in block 118. In one embodiment, the computer will then notify the user that the user can now safely disconnect the external data storage device without risk of data loss, as illustrated in block 120. In one embodiment, this notification comprises displaying a message to the user indicating that it is safe to disconnect the external data storage device from the computer. In another embodiment, notifying the user may comprise illuminating a light or displaying a message on the external data storage device to indicate that it is safe to disconnect the external data storage device. In yet another embodiment, notifying the user may comprise an audible notification, such as a tone or a computerized voice.

[0030] Fig. 5 is a flow chart illustrating an exemplary process 130 for preventing data loss due to disconnecting an external data storage device in accordance with embodiments of the invention. As stated above, disconnecting an external data storage device without executing a file update routine can result in file corruption or data loss. As indicated in block 132, the process 130 begins with the detection of a disconnection of an external data storage device. After detecting the disconnection, the process 130 continues by determining whether a file update routine was run for the disconnected external data storage device. In one embodiment, the process will determine if the file update routine was run prior to the disconnection of the

external data storage device. If the file update routine was run, the process 130 ends, as indicated in block 138. If, however, the file update routine was not run for the external data storage device, the process 130 will determine whether the file update routine should be run for the disconnected external data storage device (i.e., are there any files in the computer memory that have non-updated copies on the external data storage device). If the file update routine did not need to be run, the process 130 ends as indicated in block 138. Those skilled in the art will appreciate that in alternate embodiments, blocks 134 and 136 can be swapped. In other words, in alternate embodiments, the process 130 first determines whether the file update routine needed to be run and then determines whether the file update routine was run.

[0031] If the file update routine should have been run prior to the disconnection of the external data storage device, the process 130 continues by prompting the user to reconnect the external data storage device, as indicated by block 140. Once the user reconnects the external data storage device, the process 130 concludes by executing the file update routine for the external data storage device, as indicated in block 142.

[0032] While the blocks outlined with regard to Figs. 4 and 5 have been illustrated in the order discussed above, this order is merely exemplary. In alternate embodiments, the order of the blocks can be modified. Further, blocks may be added, deleted, modified, or rearranged and still be within embodiments in accordance with the present invention.

[0033] Many of the steps of the exemplary processes described above with reference to Figs. 2, 3, 4, and 5 comprise an ordered listing of executable instructions for implementing logical functions. The ordered listing can be embodied in a computer-readable medium for use by or in connection with a computer-based system that can retrieve the instructions and

execute them to carry out the previously described processes. In the context of this application, the computer-readable medium can be a means that can contain, store, communicate, propagate, transmit or transport the instructions. By way of example, the computer readable medium can be an electronic, a magnetic, an optical, an electromagnetic, or an infrared system, apparatus, or device. An illustrative, but non-exhaustive list of computer-readable mediums can include an electrical connection (electronic) having one or more wires, a portable computer diskette, a random access memory (RAM) a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, and a portable compact disk read-only memory (CDROM). It is even possible to use paper or another suitable medium upon which the instructions are printed. For instance, the instructions can be electronically captured via optical scanning of the paper or other medium, then compiled, interpreted or otherwise processed in a suitable manner if necessary, and then stored in a computer memory.

CLAIMS

What is claimed:

1. An external data storage device comprising an activatable component to transmit a request to disconnect the external data storage device from a computer, wherein the activatable component comprises an apparatus capable of being physically or electrically activated.

2. The external data storage device, as set forth in claim 1, wherein the external data storage device comprises an external hard disk drive.

3. The external data storage device, as set forth in claim 1 or 2, wherein the activatable component comprises a button or a switch on a housing of the external data storage device.

4. The external data storage device, as set forth in any of claims 1 to 3, wherein the activatable component comprises a touch or temperature sensitive pad.

5. A computer system comprising:

a computer; and

an external data storage device configured to send a signal to the computer when a user-activated component located on the data storage device is activated, wherein the signal comprises a request to disconnect the data storage device from the computer.

6. The computer system, as set forth in claim 5, wherein the external data storage

device sends a request to activate a software routine to safely remove the external data storage device.

7 The computer system, as set forth in claim 5 or 6, wherein, the computer is configured to copy a file from a memory of the computer system to the external data storage device after the user-activated component is activated, wherein the file was previously copied from the external data storage device to the computer's memory.

8. The computer system, as set forth in any of claims 5 to 7, wherein the computer updates a file on the external data storage device if a copy of the file stored in a memory of the computer system does not match the file.

9. The computer system, as set forth in any of claims 5 to 8, wherein the computer logically severs a connection between the external data storage device and the computer after the user-activated component is activated.

10. The computer system, as set forth in claim 9, wherein the computer copies one or more pre-designated files to the external data storage device before logically severing the connection.

11. An external data storage device substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

12. A computer system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

The Patent Office

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16

Application No:	GB0607172.4	**Examiner:**	Nigel Hanley
Claims searched:	1-10	**Date of search:**	7 July 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,Y	X: 1-9 Y: 10	US 2004/0236980 A1 CHEN - See whole document especially Fig 7 and paragraphs 0043 - 0049 and 0057. Note use of control buttons to allow a shutdown of a program running on a flash memory device. Note also application of method to other storage devices.
X,Y	X:1-6 & 9 Y:10	Western Digital - WD Dual-Option External USB Hard Drive - Quick Install Guide Retrieved from http://www.wdc.com/en/library/dual-option/2079-001049.pdf - PDF first created 27/5/2004 See especially Section 5 and use of power/safe shutdown button.
X	1,3-6 & 9	JP 2004094494 A CANON - See abstract and figures. Note the provision of a storage processor for connecting a memory card to a PC. Note especially the provision of a power supply switch to allow for safe disconnection of the device.
X	1,2 & 5	US 5721838 A FUJITSU - See whole document especially Figs 1, 4a & b and 11. Note operation of a switch 11 to allow a disk drive to be safely disconnected from a system to allow for addition/replacement of a disk.
X,&	1 & 5	WO 2004/047111 A1 OKAUE - See whole document especially Figs 1-7. Note the provision of a switch on an insertable media device.
A,&		US 2005/0086433 A1 OKAUE - US Equivalent of WO 2004/047111 and published in English. Note particularly the operation of a switch to the midpoint which disconnects the card from the host device.
Y	10	US 6389500 B1 LIN - See whole document. Note inhibition of a reset button to allow for programming operations on a flash memory device to be continued so as to allow safe disconnection.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.

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&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

G4A

Worldwide search of patent documents classified in the following areas of the IPC

G06F

The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC, JAPIO, Internet