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Data input device, systems using the device, and methods for operating such systems

Field of the invention

The present invention relates to a data input device for inputting data to a computer system, and to methods of operating it. The data input device is further arranged to have a data storage function.

Background of Invention

Recently there has been great interest in providing data storage devices using which a user is able to transfer data between components of a computer system, or between computer systems.

For example, one of the present inventors has proposed in PCT application PCT/SG01/00136, published as WO 03/003141, entitled "Method and devices for data transfer" (the disclosure of which is incorporated herein by reference) a data storage device for use in a computer system including a computer device and one or more other external electronic devices. The external devices are of the type referred to as "slave devices", and examples of such electronic devices include a camera, a video camera, a organiser, an MP3 player, or a PDA (personal assistant). The data storage device includes a wireless transceiver (transducer) for receiving data (which the data storage device stores), and for transmitting data stored within it. The computer device too, and each of the other electronic devices, includes a respective wireless transducer. Thus, the data storage device can be used for transferring data between the computer device and the various external devices. Since the storage device is substantially devoted to storage of data, it can accommodate a memory which is larger than in most other portable electronic items. Furthermore, since the data transfer is wireless, physical connectors

(such as cables, sockets and plugs) are not required, so data can be transferred within the computer system despite the very large number of existing standards for physical connectors.

Summary of the Invention

Although the data storage device proposed in PCT/SG01/00136 has proved practically useful, it constitutes an additional element which a user of the computer system has to obtain and use (e.g. to carry around when the computer system is to be transported).

The present invention aims to provide a new and useful data storage device.

In general terms, the invention proposes that the data storage device should be shaped in the form of a stylus, that is having a tip for indicating a position. The stylus permits the device to be used for data entry to a electronic device which measures the position of the stylus tip (e.g. a device having a touch sensitive surface). Thus, the data storage device can be used in place of a conventional stylus. In other words, a user of an electronic device which traces the position of a stylus is able to enjoy the advantages of a wireless memory storage device without being obliged to use an additional component.

Specifically, a first expression of the invention is a data storage device defined in claim 1 of the appended claims.

Preferably, the data storage device further includes at least one biometric sensor for recording a biometric characteristic of a user, and a verification processor for comparing the biometric characteristic with a characteristic stored by the sensor, the verification processor controlling whether the data storage device performs at least one of its functions in dependence upon whether the recorded biometric characteristic matches the stored characteristic.

For example, the biometric sensor may be a fingerprint sensor, and the data storage device may include a verification processor arranged to compare a fingerprint received by the fingerprint sensor with a stored fingerprint.

Preferably, the data storage device only transmits data stored within it when the verification processor determines that there is a match between the recorded biometric characteristic and the stored characteristic.

Note that it is not indispensable to the invention that the verification processor and control processor are physically different units. The verification processor and the control processor may, if desired, be different functions of a single integrated circuit (master control unit). Alternatively, any other number of integrated circuits may be used to implement together the function of the control processor and verification processor.

The device may include the capability to compress/decompress data which is to be stored, or has been stored, in the non-volatile memory. This can be implemented by the processor which stores data into and retrieves data from the non-volatile memory, or alternatively by a dedicated microprocessor unit.

The device may be integrated with an image capturing device (camera) for generating data which can be stored in the non-volatile memory, and subsequently transmitted through the wirless transceiver.

The device may incorporate at least one smart card, for providing at least one enhanced security feature.

A second expression of the invention is a system defined in claim 8.

The first electronic device may for example have a surface, and means for detecting the movement of the stylus over the surface. For example, the surface may be touch sensitive.

One possibility is for the first electronic device to be a tablet PC, an organiser or a PDA (personal assistant).

In addition to the first electronic device, the system may comprise one or more further electronic devices which include respective wireless transceivers for exchanging data with the data storage device. Thus, the data storage device may be arranged as a "bridge", which can be used to store data received from a first of the electronic devices and subsequently to transmit that data to a second of the electronic devices (optionally with some processing of the data within the data storage device, such as an encoding operation).

Preferably, the system is a computer system, in which one of the electronic devices is a PC, and other of the electronic devices are "slave devices" of the PC, such as the PDA.

Each of the wireless transceivers preferably operates by electromagnetic waves, and most preferably by RF or infra-red waves. In the former case, the transceiver may consist of an antenna and RF interface circuitry. Irrespective of the wireless waves employed, the transceiver may use any protocol presently in existence or which may become available in the future, for example it may be capable of sending and/or receiving signals in at least one of (i) IEEE802.11, (ii) Bluetooth, or (iii) irDA.

It is also possible that the data storage device may be capable of receiving/transmitting in multiple formats, so that it can interpret between two slave devices which use different formats.

Preferably, any of the electronic devices which includes an internal memory is arranged, upon that internal memory becoming full, or at least the amount of data passing a predefined limit, to initiate communication with the data storage device, so that the data can be transferred to the data storage device.

Preferably all communications carried out by the data storage device include a process of establishing the identity of the other device (computer device or slave device) using an ID code received from that device and compared with list of ID codes stored internally by the data storage device.

A third expression of the invention is a method of transferring data wirelessly between a data storage device of the kind discussed above and another electronic device as defined in claim 18.

Brief Description of The Figures

Preferred features of the invention will now be described, for the sake of illustration only, with reference to the following figures in which:

Fig. 1 is a schematic view of a computer system including data storage device which is a first embodiment of the invention;

Fig. 2, which is composed of Figs. 2(a) and 2(b), is schematic views of the data storage device of Fig. 1;

Fig. 3 shows the steps performed by the data storage device in a first method employing the system of Fig. 1;

Fig. 4 shows the steps performed by the data storage device in a second method employing the system of Fig. 1;

Fig. 5 shows the steps performed by the data storage device in a third method employing the system of Fig. 1;

Fig. 6 shows the processes of Figs. 4 or 5 from the point of view of a user;

Fig. 7 shows schematically a side view of a data storage device which is a second embodiment of the invention; and

Fig. 8 shows the internal construction of the embodiment of Fig. 7.

Detailed Description of the embodiments

Referring to Figure 1, a system embodying the invention includes a PC 1 having an antenna 3. The system also includes a data storage device 5, having an antenna 37 (not shown in Fig. 1). The system further includes a plurality of electronic ("slave") devices 9, 19 which are external to the computer device 1 and spatially separated from it, but which may usefully communicate data to and/or from the PC 1. Each external device 9, 19 has an antenna 11. For simplicity only two slave devices 9, 19 are illustrated in

Figure 1. The data storage device 5 and each of the external devices 9, 19 are portable. For example, their weight is preferably less than 1 kilogram each, and each preferably includes an internal power source such as a battery.

The PC 1 and the data storage device 5 can communicate using the antenna 3 and the antenna of the data storage device 5. Similarly, the data storage device 5 and the external devices 9, 19 can communicate using the antenna of the data storage device 5 and the antennas 11. Both forms of communication may be using any of the communication protocols IEEE802.11, Bluetooth, irDA, etc. As described below, any of the slave devices 9, 19 can send data selectively to the PC 1 or to any of the other slave devices 9, 19 via the data storage device 5. The PC 1 can send data to a selected one of the slave devices 9, 19 via the data storage device. All of this communication is digital, and the data storage device 5 is for digital data. In addition, it is possible that the data may be sent in an encrypted form.

Note that at least one (and possibly all) of the slave devices 9, 19 may not require two-way communication with other slave devices 9, 19 or the PC 1. For example, in the case of a slave device 9 which is a digital camera, the data transmitted via the master storage device 5 may largely (or exclusively) be from the digital camera to the PC 1.

Turning now to Fig. 2, the construction of the data storage device 5 is shown, respectively as a side view (Fig. 2(a)) and as a block diagram (Fig. 2(b)).

The device 5 includes an outer housing including a stylus portion 23 having a tip 25. The antenna of the device 5 is not shown, but is preferably provided at or proximate the end of the device 5 which is opposite from the stylus portion 23 (i.e. at the other end of the housing). The exterior surface of the housing includes a fingerprint sensor 27 having a surface 29 which is substantially

plush with the housing. When a user applies his finger to the surface 29, the fingerprint is recorded.

The interior of the data storage device 5 includes a data storage module 31, a microcontroller (master control unit) 33 in two-way communication with the data storage module 31 and with the fingerprint sensor 27. The microcontroller 5 is further in communication with a transceiver 35 comprising an antenna 37 and RF interface circuitry 39. The transceiver 35 is arranged for receiving an RF signal by the antenna 37, and to extract digital data from it in the RF interface circuitry 39, which passes the data to the microcontroller 33, which stores it in the storage module 31. When the data storage device 5 is to transmit data, the microcontroller 33 issues a signal to the storage module 31 which transmits data stored within it to the microcontroller 33, which then passes the data to the transceiver 35 for transmission.

Optionally, the operations of the data storage device 5 (and in particular the operation of transmitting data via the transceiver 35) are only enabled in the case that fingerprint sensor 27 has recorded a fingerprint, transmitted it as fingerprint data to the microcontroller 33, and the microcontroller has compared that fingerprint data to data pre-stored in the storage module 31 (or in some other memory, which is not shown).

The memory capacity of storage module 31 of the data storage device 5 may for example be at least 8MB, at least 1GB, at least 10 GB, or at least 20 GB. The storage module 31 of the storage device 5 can be, for example, a magnetic disk drive or any other suitable non-volatile data storage device, such as an electrically erasable programmable read only memory (EEPROM), a ferroelectric random access memory (FRAM), a magetoresistive random access memory (MRAM), or any other data storage device which may become available in the future.

Turning to Fig. 3, a method using the system of Fig. 1 is shown. In this method, the data storage device 5 receives and stores data from one of the slave devices 9, 19. Initially, the data storage device 5 is in a waiting state 41. In step 43, the transceiver 35 receives data via the antenna 37 from the other of the devices 9, 19, and passes it to the microcontroller 33.

In step 45, the microcontroller 33 uses the fingerprint sensor 27 to verify the finger print of a user holding it. If the measured fingerprint does not match the fingerprint data stored in the storage module 31, an error message is generated in step 47, and the device returns to the waiting state 41.

Otherwise, in step 49, the device verifies an ID (password) of the slave device from the data it received (e.g. comparing the ID encoded in the data with an ID stored in a list in the storage module 31). If this verification process fails, the device moves to step 47. Otherwise, the device passes to step 51 in which the microcontroller 33 creates a directory in the storage module 31, and step 53 in which the device continues to receive data from the slave device 9, 19 and stores it in the storage module 31.

Turning to Fig. 4, a second method using the system of Fig. 1 is shown. In this method, the data storage device 5 receives and stores data from the PC 1. Initially, the data storage device 5 is in a waiting state 61. In step 63, the transceiver 35 receives data via the antenna 37 from the PC 1 indicating that the user of the PC has used a touch screen, keyboard or mouse input device to signal that data is to be written from the PC 1 to the memory device 5.

In step 65, the microcontroller 33 uses the fingerprint sensor 27 to verify the finger print of a user holding it. If the measured fingerprint does not match the

fingerprint data stored in the storage module 31, an error message is generated in step 67, and the device returns to the waiting state 61.

Otherwise, in step 69, the device verifies an ID of the PC 1 within the data it received (e.g. comparing a ID encoded in the data with an ID stored in the list in the storage module 31). If this verification process fails, the device moves to step 67. Otherwise, the device passes to step 71 in which the microcontroller 33 receives data from the PC 1 using the transceiver 35, and step 73 in which the microcontroller 33 stores the data in the storage module 31.

Turning to Fig. 5, a third method using the system of Fig. 1 is shown. In this method, the data storage device 5 transmits data to the PC 1. Initially, the data storage device 5 is in a waiting state 81. In step 83, the transceiver 35 receives data via the antenna 37 from the PC 1 indicating that the user of the PC has used a touch screen, keyboard or mouse input device to signal that data is to be written to the PC 1 from the memory device 5.

In step 85, the microcontroller 33 uses the fingerprint sensor 27 to verify the finger print of a user holding it. If the measured fingerprint does not match the fingerprint data stored in the storage module 31, an error message is generated in step 87, and the device returns to the waiting state 81.

Otherwise, in step 89, the device verifies an ID of the PC 1 within the data it received (e.g. comparing a ID encoded in the data with an ID stored in the list in the storage module 31). If this verification process fails, the device moves to step 87. Otherwise, the device passes to step 91 in which the microcontroller 33 receives data from storage module 31, and in step 93 sends it to the PC 1 using the transceiver 35.

A process very similar to that shown in Fig. 5 occurs in the case that data is to be transmitted to one of the slave devices. It differs in that step 83 is replaced by a step in which the storage device 5 receives a read request from the slave device and passes it to the microcontroller 33, step 89 is replaced by a step in which the identity of the slave device is confirmed using an ID of the slave device, and step 93 is replaced by a step in which the data is transmitted by the transceiver 35 to the slave device.

Figs. 4 and 5 showed the process of transferring data between the data storage device 5 and the PC 1 from the point of view of the device 5. However, referring to Fig. 6, these processes are shown from the point of view of a user.

In step 101, a user brings the stylus close to the PC, within the range of their respective transceivers 3, 35. In step 103, a pop-up message appears on the screen of the PC asking the user to verify his identity by placing his finger on the sensor 27 of the stylus 5.

In step 105, a determination is made by the microcontroller 33 of whether there is a match. If not, in step 107 the user is invited to retry, or terminate the attempt.

Otherwise in step 109, the operating system of the PC (or other host system) is configured to recognise an external drive (corresponding to the storage module 31), and in step 110 the user can read or write to/from the storage module 31 of the stylus 5 by the touch screen, keyboard or mouse.

In addition to these functions, the user is additionally able to enter data into a electronic device such as the PDA 19 which is able to trace the movements of the tip 25 of the stylus portion 23. The way in which the electronic device 19

tracks the position of the tip 25 may be according to any known technique, or any which may become available in the future. For example, it may be by providing a touch sensitive surface 15 on the PDA 19, so that the user can stroke this surface with the tip 25. Alternatively, the position of the tip 25 may for example be detected by a sonar or radar technique. The user thus has all the functionality available from the stylus of any known system, in addition to the data storage capacity of the data storage device 5.

Fig. 7 shows a second embodiment of a data storage device according to the invention. Items of Fig. 7 corresponding to those of Fig. 2(a) are given reference numerals 100 higher. The data storage device incorporates a digital camera device 140 within the same housing. The digital camera device 140 is capable of taking images (still images, and/or in certain versions of the embodiment moving images). The device may also include a sound receiving device (microphone) 142 capable of recording audio sound.

The functional structure of the second embodiment is as shown in Fig. 8. Elements corresponding to those of Fig. 2(b) are given reference numerals 100 higher. Data representing the images and/or sound captured by the camera 140 and microphone 142 are stored by the micro-controller 133 in the memory 131. As in the first embodiment, RF interface circuitry is provided, for receiving data from and transmitting data to an antenna 37.

Note that the device preferably has all the functionality of the first embodiment. That is, it is able to receive data via the aerial 137, store it in the memory unit 131, and then re-transmit it, so that in this way the data storage device can transfer data among a plurality of devices.

A further possible enhancement of both of the first and second embodiments of the invention is that they may be provided with the capability to compress

data which is to be stored in the memory units 31, 131. This is related to the concept discussed in PCT patent application "System and Apparatus for Compressing and Decompressing Data Stored to a Portable Data Storage Device", PCT/SG02/00086, filed 13 May 2002, the entire disclosure of which is incorporated herein by reference. The compression algorithm may for example be stored in a ROM memory and uploaded into the processors 33, 133 and performed there. Alternatively, the device may contain a separate compression engine (not shown).

Optionally, in addition to data compression, the portable storage device is arranged to decompress the data before transmitting out of the device. Again this may be performed by the processors 33, 133, or by a decompression engine, which may in fact by the same microprocessor as the compression engine.

Another possible enhancement of both of the first and second embodiments of the invention is that the device may include some form of "smart card", to provide one or more additional security functions, e.g. to detect some improper usage of the device and, upon this detection, to alter the functioning of the device, for example to inhibit the transmission of data from the memory modules 31, 131 (or indeed to delete all data stored there).

Many forms of smart card are known, including for example cards which can sense that the housing of the device has been opened, and cards which contain identity information. Optionally, for example, the fingerprint sensing described above can be implemented using the smart card.

Note that, although the invention has been described above with reference to only two embodiments, many further variations are possible within the scope of the invention as will be clear to a skilled reader. For example, it is possible

for the data storage device 5 to include a physical interface allowing it to be connected to another electronic device or apparatus allowing data to be transmitted into or out of the data storage device respectively from or to the other electronic device via the physical interface. For example, the physical interface may be a plug, such as a USB plug or a Firewire plug, which can be directly connected to a socket in the other electronic device.

Also, the data storage device 5 need not be limited to use within a single computer system, but may be used to transfer data between different computer systems, each of which may have one or more respective PCs and each of which may have one or more slave devices.

Claims

1. A data storage device having:

a non-volatile memory of at least 8Mbyte,

a wireless transceiver for transmitting and receiving data;

a control processor for storing data received by the wireless transceiver in the memory, and for extracting that same data from the memory and transmitting it to the wireless transceiver for transmission; and

a housing having an outer profile including a stylus portion defining a tip,

wherein the data storage device is configured to receive wirelessly data for storing from, and to transmit wirelessly stored data to, another electronic device; the other electronic device initiating the transmission to and from the data storage device.

2. A data storage device according to claim 1 further comprising at least one biometric sensor for recording a biometric characteristic of a user, and a verification processor for comparing the biometric characteristic with a characteristic stored by the sensor, the verification processor controlling whether the data storage device performs at least one of its functions in dependence upon whether the recorded biometric characteristic matches the stored characteristic.

3. A data storage device according to claim 2 in which the biometric sensor is a fingerprint sensor, and the data storage device includes a verification processor arranged to compare a fingerprint received by the fingerprint sensor with a stored fingerprint.

4. A data storage device according to claim 2 or claim 3 which is arranged only to transmit data stored within it when the verification processor determines that there is a match between the recorded biometric characteristic and the stored characteristic.

5. A data storage device according to any preceding claim which is integrated with a camera device, the camera device being arranged to generate data representing images and to store the image data in the non-volatile memory.

6. A data storage device according to any preceding claim in which the control processor is arranged to perform a compression algorithm to compress data which is to be stored in the non-volatile memory.

7. A data storage device according to any preceding claim further including a smart card for performing at least one security function in relation to data stored in the non-volatile memory.

8. A system comprising:

(i) data storage device having:

a non-volatile memory of at least 8Mbyte,

a wireless transceiver for transmitting and receiving data;

a control processor for storing data received by the wireless transceiver in the memory, and for extracting that same data from the memory and transmitting it to the wireless transceiver for transmission; and

a housing having an outer profile including a stylus portion defining a tip; and

(ii) another electronic device having means to trace the position of the stylus of the data storage device, and a wireless transceiver for communicating with the wireless transceiver of the data storage device;

whereby the user can enter data to the other electronic device by moving the stylus such that the position of the stylus is traced by the other electronic device, and communicate data between the other electronic device and the data storage device using the respective transceivers, and

wherein the system is arranged such that the other electronic device is operable by the user moving the device such that the other electronic device traces the position of the data storage device to initiate both the wireless transmission of data from the other electronic device to the portable data storage device for storage therein, and the wireless transmission from the portable data storage device of data stored therein to the other electronic device.

9. A system according to claim 8 in which the other electronic device includes a surface, and means for detecting the movement of the stylus over the surface.

10. A system according to claim 9 in which the surface is touch sensitive.

11. A system according to any of claims 8 to 11 in which the other electronic device is an organiser or a PDA (personal digital assistant).

12. A system according to any of claims 8 to 11 which further comprises one or more further electronic devices which include respective wireless transceivers for exchanging data with the data storage device.

13. A system according to any of claims 8 to 12 in which one of the electronic devices is a PC, and other of the electronic devices are slave devices of the PC.

14. A system according to any of claims 8 to 13 in which each of the wireless transceivers operates by electromagnetic waves and includes an antenna and RF interface circuitry.

15. A system according to any of claims 8 to 14 in which the storage device is adapted for receiving/transmitting in multiple formats, whereby the data storage device interprets between two of the electronic devices which use different formats.

16. A system according to any of claims 8 to 14 in which all communications carried out by the data storage device and one of the other electronic devices include a process of establishing the identity of the other electronic device using an ID code received from that device and compared with list of ID codes stored internally by the data storage device.

17. A method of transferring data between a data storage device according to claim 1 and another electronic device which incorporates means for tracking the position of the tip of the stylus, the method including at least one of the operations of:

(i) a transceiver of the other electronic device transmitting the data wirelessly to the transceiver of the data storage device, or

(ii) the transceiver of the data storage device transmitting the data wirelessly to the transceiver of the other electronic device.

18. A method for transferring data wirelessly between a data storage device and another electronic device, the data storage device having a housing with an outer profile including a stylus portion defining a tip, the method including the steps of:

a) a user operating the other electronic device to initiate the wireless transmission of data from that device to the portable storage device;

b) the portable storage device wirelessly receiving the data;

c) the portable storage device storing the received data in non-volatile memory of the portable storage device having a capacity of at least 8Mbyte; and

d) the user operating the other electronic device, or a further electronic device, to initiate transmission of the stored data by the portable storage device to the device by which that transmission from the portable storage device was initiated; and

e) the portable data storage device extracting the stored data from the memory and wirelessly transmitting it to the device by which transmission was initiated in step (d).