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I served as Chief Examiner of the certified court interpreter test for the State of California and as a translator and interpreter for various federal agencies through the U.S. Department of State of for more than a decade. I served as an instructor at the University of California at Berkeley and the Middlebury Institute of International Studies at Monterey.

I have more than 30 years of experience translating thousands of technical, legal, and business submitted to, among others, Korean judicial authorities, various U.S. federal courts, the U.S. International Trade Commission (ITC), and the USPTO Patent Trial and Appeal Board (PTAB).

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I certify under penalty of perjury that the foregoing is true and correct.

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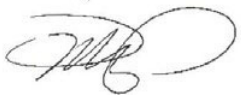

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JP 2007-281864 A, Oct. 25, 2007, Paragraphs 0023-0042 of the specification and FIGS. 1-8;
CN 1372752 A, Oct. 02, 2002, entire content

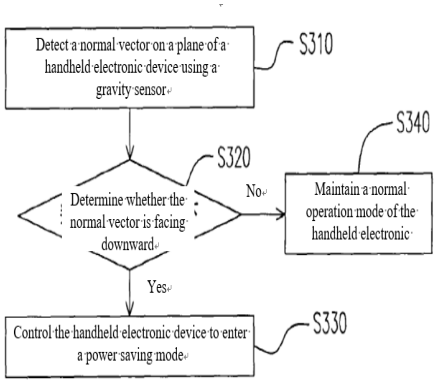
1 page of Claims, 5 pages of Specification, 4 pages of Attached Drawings

(54) Title of the Invention

POWER MANAGEMENT METHOD FOR HANDHELD ELECTRONIC DEVICE

(57) Abstract

The invention discloses a power management method for a handheld electronic device, which uses a gravity sensor (G-sensor) to detect the normal vector in the plane of the handheld electronic device and determine whether the normal vector is facing downward. In a power saving mode, the gravity sensor continues to detect the normal vector, and when the normal vector deviates from the downward direction, the handheld electronic device is controlled to return to a normal operation mode. Accordingly, according to a placement state of the device, the handheld electronic device is controlled in time to enter the power saving mode, without complicated procedures such as menu operations, etc., thus providing a more intuitive and convenient power management approach.



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1. A power management method for a handheld electronic device, comprising the steps of:

detecting a normal vector in a plane of the handheld electronic device using a gravity sensor;

determining whether the normal vector is facing downward; and

if the normal vector is facing downward, determining whether a state of the normal vector facing downward is maintained for more than a first specific time; and

when the state of the normal vector facing downward is maintained for more than the first specific time, controlling the handheld electronic device to enter a power saving mode.

2. The method according to claim 1, wherein the plane of the handheld electronic device is a plane containing a screen of the handheld electronic device when the handheld electronic device is placed horizontally.

3. The method according to claim 1, wherein the handheld electronic device is a flip handheld electronic device, and the plane of the handheld electronic device is an upper cover containing a screen of the handheld electronic device.

4. The method according to claim 1, wherein the normal vector comprises an x-component, a y-component and a z-component.

6. The method according to claim 4, wherein the step of determining whether the normal vector is facing downward comprises:

determining whether the z-component of the normal vector is negative and its x-component and y-component each falls in a specific range; and

when the z-component of the normal vector is negative and both its x-component and y-component fall within that specific range, determining that the normal vector is facing downward.

6. The method according to claim 4, wherein the step of determining whether the normal vector is facing downward comprises:

determining whether the z-component of the normal vector is negative and its x-component and y-component are both zero; and

when the z-component of this normal vector is negative and its x-component and y-component are both 0, determining that the normal vector is facing downward.

7. The method according to claim 1, characterized by further comprising:

continuing to detect the normal vector of the plane of the handheld electronic device;

determining whether the normal vector deviates from the downward-facing direction; and

if the normal vector deviates from the downward direction, controlling the handheld electronic device to return to a normal operation mode.

8. The method according to claim 7, wherein after the step of determining that the normal vector deviates from the downward direction, the method further comprises:

determining whether a state of the normal vector deviating from the downward direction is maintained for more than a second specific time; and

controlling the handheld electronic device to return to the normal operation mode when the state of the normal vector deviating from the downward direction is maintained for more than a second specific time.

9. The method according to claim 7, wherein the entry of the handheld electronic device to the power saving mode is controlled by an operating system of the handheld electronic device, and the return to the normal operation mode is controlled by an embedded controller of the handheld electronic device.

10. The method according to claim 1, wherein the power saving mode comprises one of a sleep mode and a hibernate mode.

POWER MANAGEMENT METHOD FOR HANDHELD ELECTRONIC DEVICE

Technical Field

[0001] The present invention relates to a power management method, and in particular, a power management method using a gravity sensor.

Background Art

[0002] With the rapid changes in technology, the functions provided by handheld electronic devices such as mobile phones, personal digital assistants and notebook computers tend to be diversified. In addition to basic functions such as calling, text messaging and note taking, the connection to the Internet for web page browsing and email sending and receiving has also become one of indispensable functions of handheld electronic devices. Various functions not only can bring people convenience in life, but also can be used as tools for leisure and entertainment at ordinary times, which makes handheld electronic devices become one of the most popular high-tech electronic products nowadays.

[0003] Handheld electronic devices are mostly used in outdoor locations, and in this situation where there is no external power supply, the power of the entire handheld electronic device can only be supplied by a battery installed in it. It can be seen that for handheld electronic devices, power management is the most important issue. How to implement the timely control of the handheld electronic device to enter a power saving mode according to an operation state of a user to thus improve the use efficiency of the battery extend the battery life is particularly critical for the power management.

[0004] However, for the current power saving function of the handheld electronic device, the user needs to preset a period of time, and the handheld electronic device will enter the power saving mode only when the user's operation on the handheld electronic device stops and the accumulated stop time exceeds the preset time. In this pattern, a state needs to be maintained for a period of time before the handheld electronic device enters the power saving mode, still consuming a lot of power. In addition to the above pattern of presetting a time, the user can also manually search for and enable the power saving mode through multiple menu selections when stopping using the handheld electronic device. However, this manual pattern not only wastes time, but also requires relatively complex operations that often make the user feel reluctant to perform, and in the end cannot achieve the power saving effect.

Summary of the Invention

[0005] In view of this, the present invention provides a power management method for a handheld electronic device that uses a gravity sensor (G-sensor) to detect a tilt state of the handheld electronic device to determine whether to enter a power saving mode and thus save power.

[0006] In order to achieve the above or other purposes, the present invention proposes a power management method for a handheld electronic device. First, the gravity sensor is used to detect a normal vector on a plane of the handheld electronic device, then it is determined whether the normal vector is facing downward, if the normal vector is facing downward, it is determined whether a state of the normal vector facing downward is maintained for more than a first specific time, and the handheld electronic device is controlled to enter the power saving mode when the state of the normal vector facing downward is maintained for more than the first specific time.

[0007] In the present invention, preferably the plane of the handheld electronic device is a plane containing a screen of the handheld electronic device when the handheld electronic device is placed horizontally.

[0008] In the present invention, preferably the normal vector includes an x-component, a y-component and a z-component. The step of determining whether the normal vector is downward facing includes determining whether the z-component of the normal vector is negative and the x-component and y-component of the normal vector both fall within a specific range. When the z-component of the normal

vector is negative and the x-component and y-component of the normal vector both fall within the specific range, the normal vector is determined to be facing downward.

[0009] In the present invention, preferably the above method also includes continuing to detect the normal vector on the plane of the handheld electronic device and determining whether the normal vector deviates from a downward direction, and if the normal vector deviates from the downward direction, the handheld electronic device is controlled to return to a normal operation mode.

[0010] In the present invention, preferably, after the step of determining that the normal vector deviates from the downward direction, the method also includes determining whether a state of the normal vector deviating from the downward direction is maintained for more than a second specific time, and when the state of the normal vector deviating from the downward direction is maintained for more than the second specific time, the handheld electronic device is controlled to return to the normal operation mode.

[0011] In the present invention, preferably an operating system of the handheld electronic device controls a process of the handheld electronic device entering the power saving mode, and an embedded controller of the handheld electronic device controls the returning to the normal operation mode.

[0012] In the present invention, preferably the power saving mode includes one of a sleep mode and a hibernate mode. The handheld electronic device includes one of a mobile phone, a smart phone, a personal digital assistant (PDA) phone, and an ultra-mobile personal computer (UMPC).

[0013] The invention determines whether a front side of the handheld electronic device is facing downward according to magnitudes of the normal vector on the front side of the handheld electronic device detected by the gravity sensor, so as to control the handheld electronic device to enter the power saving mode without the need to operate through the menu and other complicated procedures, but to provide a more intuitive and convenient way of power management.

[0014] In order to make the above and other purposes, features and advantages of the present invention more obvious and understandable, the following embodiments and preferable embodiments, in conjunction with the drawings, are described in detail as follows.

Brief Description of the Drawings

[0015] FIG. 1 is a block diagram of a handheld electronic device illustrated in accordance with an embodiment of the present invention.

[0016] FIG. 2 is a schematic diagram of a normal vector on a plane of the handheld electronic device illustrated in accordance with an embodiment of the present invention.

[0017] FIG. 3 is a flow chart diagram of a power management method for a handheld electronic device illustrated in accordance with an embodiment of the present invention.

[0018] FIG. 4 is a flow chart diagram of a power management method for a handheld electronic device illustrated in accordance with an embodiment of the present invention.

[0019] FIG. 5 is a flow chart diagram of a power management method for a handheld electronic device illustrated in accordance with an embodiment of the present invention.

Detailed Description

[0020] Usually when a user operates a handheld electronic device equipped with a screen, such as a bar handheld electronic device or a slide handheld electronic device, a front side (i.e., a side that includes the screen) of the device is facing upward. Even when the user stops operating the device and places it on a table or other object, the front side usually is also facing upward, unless the user does not want other people to see the contents on the screen of the device or wants to stop using the device indeed, he may place the device with the front side facing downward. In addition, if the device is a flip-up handheld electronic device, an upper cover portion provided with the screen is also facing upward or tilted upward when the user uses the device, and when the user wants to stop using the device, an upper cover provided with the screen is usually facing downward or closed to avoid other people to see the contents on the screen.

[0021] As can be seen from the above, when the device is placed with the front side facing downward

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