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(54) **NAVIGATION OF AN N-DIMENSIONAL HIERARCHICAL STRUCTURE USING A 2-DIMENSIONAL CONTROLLER**

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(51) **Int. Cl.**
G06F 3/048 (2006.01)

(52) **U.S. Cl.** **715/810**; 715/854; 715/818; 715/841; 715/850; 715/784

(58) **Field of Classification Search** 715/810, 715/854, 784, 818, 841, 850
See application file for complete search history.

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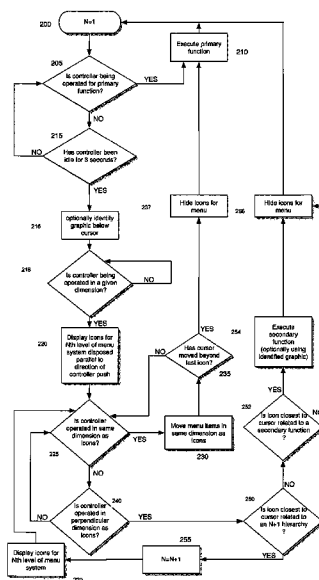
(57) **ABSTRACT**

A system and method for navigating a multi-hierarchical menu system using a two-dimensional controller, comprising displaying an Nth level of the multi-hierarchical menu system having a plurality of icons in proximity to a pointer on a portion of a display, scrolling the icons in a first dimension relative to the pointer responsive to operating the controller in the first dimension, and one of either selecting one of the icons in closest proximity to the pointer responsive to operating the controller in a first direction of a second dimension, or displaying a $N+1^{th}$ level of the multi-hierarchical menu system relative to one of the icons in closest proximity to the pointer responsive to operating the controller in an opposite direction of the second dimension.

36 Claims, 4 Drawing Sheets

Menu 120

Display
100

Pointer 130

4-Directional
Pointing
Device
110

Fig. 1
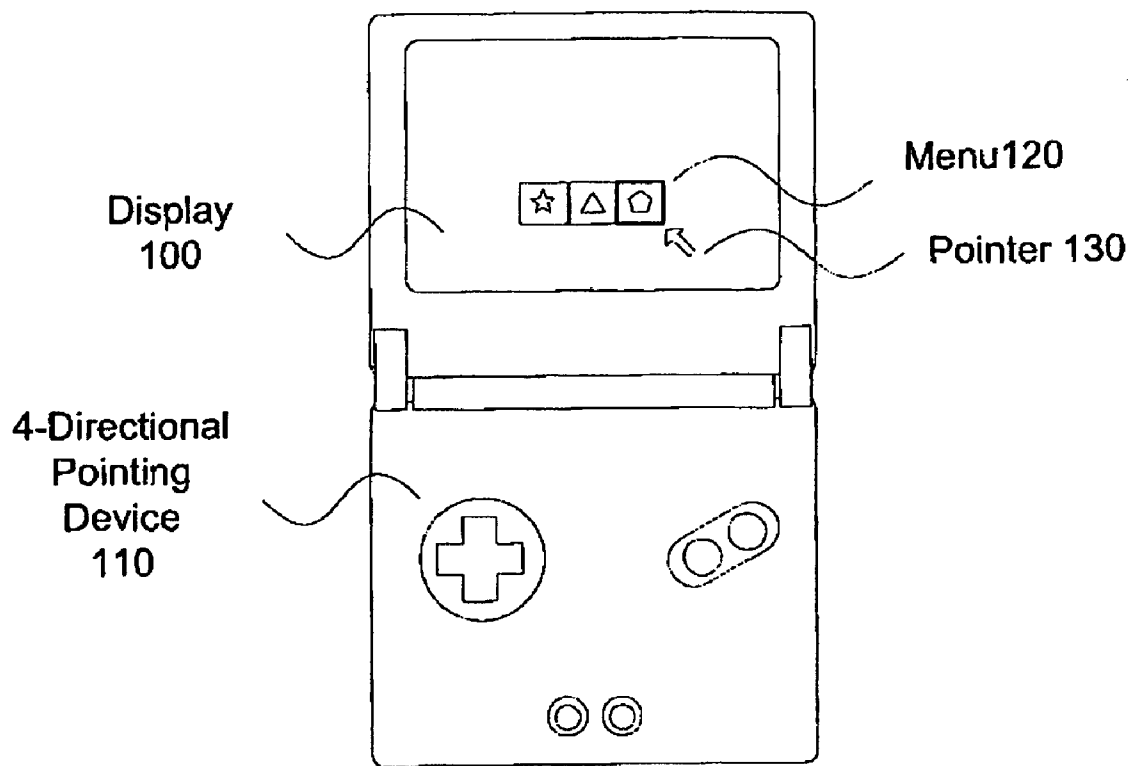
Figure 2
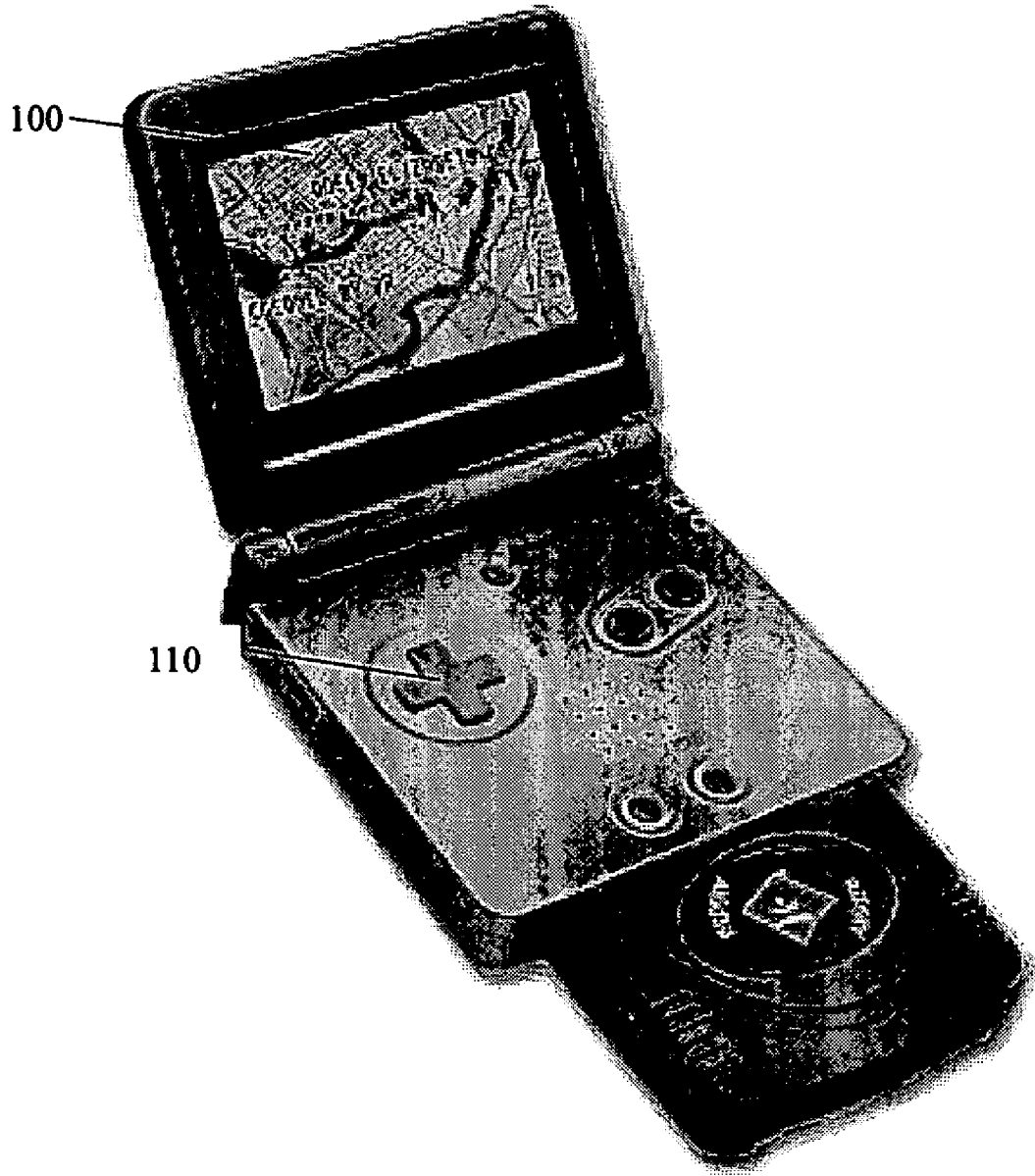
100

110

Fig 3A

120B

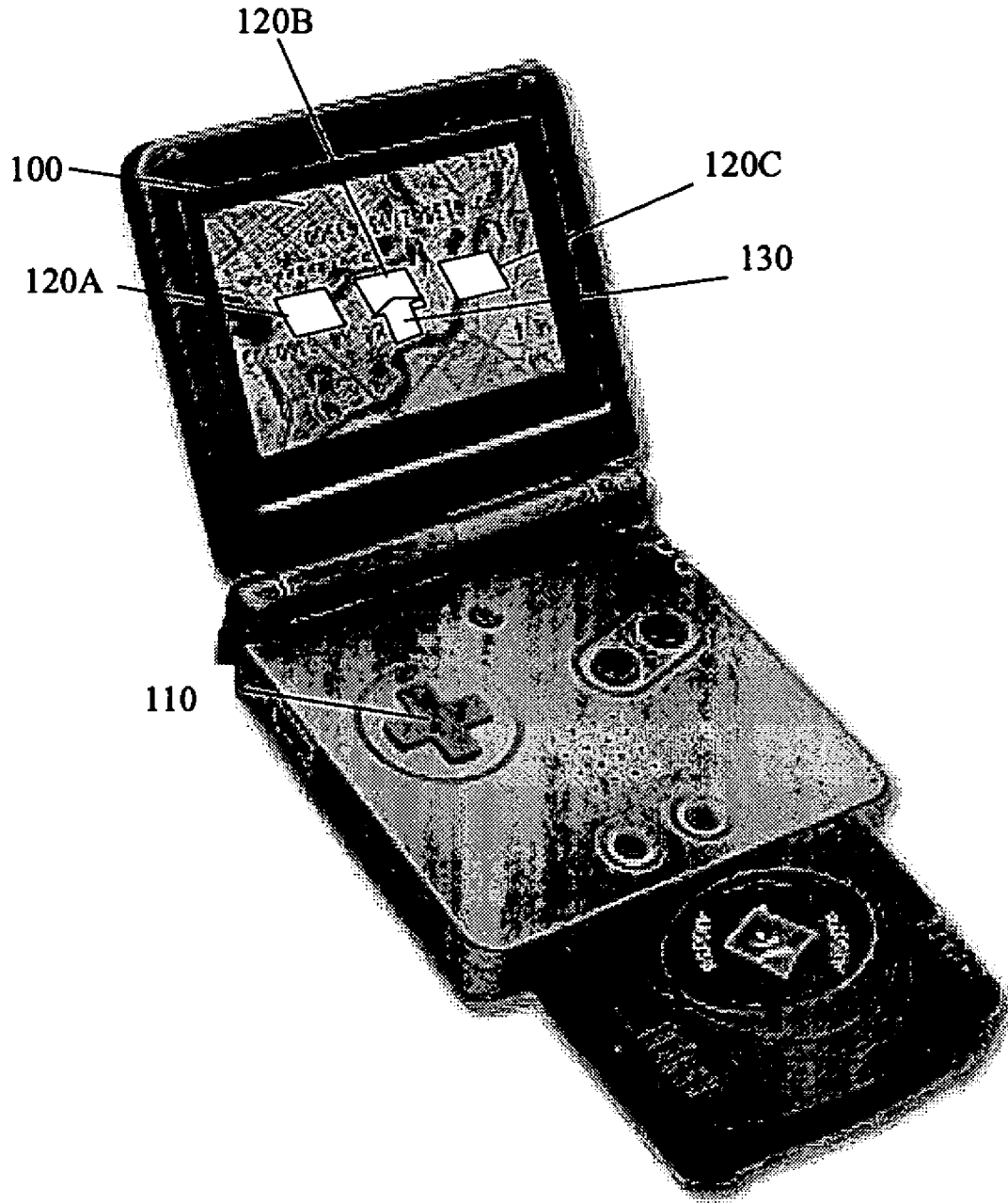100

120A

120C

130

110

Fig 3B

NAVIGATION OF AN N-DIMENSIONAL HIERARCHICAL STRUCTURE USING A 2-DIMENSIONAL CONTROLLER

CROSS-REFERENCE TO RELATED APPLICATION

The present application claims priority from U.S. Provisional Application Ser. No. 60/570,066 file May 12, 2004, the disclosures of which are incorporated herein.

BACKGROUND

1. Field

The present specification is directed generally to the navigation of a graphical user interface (GUI), and more particularly to the navigation of a multi-hierarchical menu system using a two-dimensional controller.

2. Description of the Related Art

In a typical GUI, a user is provided with a system of hierarchical menus that must be navigated using a mouse or other pointing device (e.g. trackball, digitizing tablet, directional keypad, etc.). Although such menu system navigation is relatively straightforward when using a conventional desktop or laptop computer, significant impediments to usage arise when the GUI operates on a small electronic apparatus, such as a wireless communication device and/or GPS receiver, where space limitations dictate use of a pointing device with limited directional control (e.g. a 4-directional cross-shaped keypad or a five-way selector on wireless communication device). Moreover, the presentation of layered hierarchical menus on such a device may detract from its primary use and limit interaction with the device (e.g. where the device is a GPS receiver, the presentation of layered hierarchical menus tends to clutter the display of map information, interfere with pan functions, etc.).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of an electronic device with limited display area and two-dimensional controller;

FIG. 2 depicts a flowchart illustrating a method for navigating a multi-hierarchical menu system of the electronic device, according to the preferred embodiment; and

FIGS. 3A and 3B, together, illustrate various screens of a graphical user interface (GUI) implementing the method of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

It is an aspect of the present specification to set forth a system and method for navigating a multi-hierarchical menu system of an electronic device with limited display area using a two-dimensional controller, such as a four-directional cross-shaped control pad or other limited input device.

To that end, a system and method are provided for navigating an N-dimensional hierarchical menu structure using a two-dimensional controller, by displaying a Nth level of the hierarchical menu structure in proximity to a pointer on a portion of a display by operating the controller in a first dimension, and one of either selecting a function related to an icon within the Nth level or displaying a (N+1)th level of the hierarchical menu structure by operating the controller in a second dimension perpendicular to the first dimension, or

moving the Nth level of the hierarchical menu structure relative to the pointer by operating the controller in the first dimension.

According to another aspect, the menu system may be navigated without interfering with a primary function of the electronic device. To that end, the menu system may be activated only after a predetermined period of primary function inactivity. For example, where the primary function is panning of a map navigation system, the menu system may be automatically displayed after a time-out period after the user ceases to operate the controller for the purpose of panning. Furthermore, after the timeout period, but before displaying the menu, the direction of controller operation can be advantageously used to direct the relative location and orientation of the menu on the display so as to minimize interference with the display.

These together with other aspects and advantages which will be subsequently apparent, reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

In FIG. 1, an electronic device is shown with limited area display 100 and a two-dimensional (i.e. four-directional) controller 110. The device incorporates a processor for implementing at least a primary function, as is well known in the art. A graphical user interface (GUI) is presented to the user as a first level of a hierarchical menu 120 having a plurality of icons selectable via a pointer 130. The term "icon", as used in the specification means any graphic representation on the display representing a function that can be selected by operating the controller 110. As discussed in greater detail below, the icons of menu 120 are navigable by operating the controller in a first dimension (e.g. left or right buttons, where the dimension is horizontal), thereby causing the menu 120 to move in the first dimension relative to pointer 130. A second level of the hierarchical menu (not shown) may be displayed by operating the controller in the first direction of a second dimension (e.g. the down button, where the dimension is vertical), or the icon may be selected by operating the controller in the opposite direction of the second dimension (e.g. the up button).

Turning to FIG. 2, an index (N) representing the level of menu hierarchy is initially set to 1 (step 200). In operation a user operates the controller 110 (step 205) to execute the afore-noted primary function of the device (step 210). For example, where the device 110 incorporates a GPS receiver, the primary function may be panning of a map navigation system. FIG. 3A shows the device 110 executing the primary function of panning a map. It will be noted that no icons 120 are displayed. By depressing and holding the controller 110 in one of its four directions (within two dimensions), the map depicted in display 100 is caused to pan in the direction that the device 110 is being pressed (i.e. up, down, left or right). As long as the controller 110 continues to be operated by the user, the primary function persists (step 210).

If the user releases the controller 110, the primary function (e.g. map panning) ceases, and the display 100 remains static for a predetermined time-out period (step 215). Although as illustrated the timeout period is 3 seconds, it is envisaged that those of ordinary skill in the art can use other timeout periods to adapt FIG. 2 to a particular purpose. Next, graphics (such as streets, lakes, or other map features in a map application for example) are (optionally) identified (step 216) and a software control loop is entered to detect operation of the controller 110 in any dimension (step 218). Upon detection of controller operation, the first level (N=1) of the hierarchical menu is

presented to the user (step **220**), with the icons **120** displayed parallel to the direction of controller movement (detected at step **218**). This advantageously enables the user to affect the position and orientation of the menu over the background display, to ensure for example that a select area of the display (showing an area of interest in a map for example) remains uncluttered by the menu. As shown in FIG. **3B**, icons **120A**, **120B** and **120C** are displayed over the background image (e.g. a map). Preferably, the icons **120** are context sensitive to the state of the device display. For purposes of clarity, the icons in FIG. **3B** are shown as blank boxes, without graphics. However, preferably the icons depict graphics that are, as indicated above, context sensitive and indicative of a function to be performed. For example, icon **120A** may depict a graphical image of binoculars for initiating a search function, icon **120B** may depict a push-pin for entering a GPS way-point, and icon **120C** may depict a 'U-turn' graphic for causing the map to return to the GPS current location.

In response to the user operating the controller **110** in the same dimension (step **225**) as the icons **120** are displayed (i.e. left or right, in FIG. **3B**), the icons **120** are caused to move (left or right) relative to the pointer **130** (step **230**). However, if the icons **120** are caused to move past the pointer **130** (step **235**), the icons **120** are hidden from the display **100** (step **237**) device execution reverts to the primary function (step **210**).

Of course, rather than being displayed horizontally, as shown in FIG. **3B**, the icons **120** may be displayed vertically in which case operation of the controller **110** up or down causes the icons **120** to move vertically relative to the pointer **130**.

In response to the user operating the controller **110** (step **240**) in a direction perpendicular to the presentation of the icons **120** (i.e. up or down in FIG. **3B**), the icon closest to pointer **130** may be selected. More particularly, the closest icon may be selected to perform a specific function associated with the icon, or to display a next (N+1) level of menu selection. Thus, at step **250** a determination is made as to whether the icon closest to cursor **130** relates to the next (i.e. deeper) menu level. If not, then a determination is made (step **252**) as to whether the icon closest to cursor **130** relates to a secondary function. If a determination is made (step **252**) that the icon closest to cursor **130** relates to a secondary function, then the secondary function is executed (step **254**), the icons **120** are hidden from the display **100** (step **256**), and process control returns to step **200**. For example, in FIG. **3B** icon **120B** (push-pin) is closest to pointer **130**, such that a waypoint entry function may be selected by depressing the 'up' button of controller **110**. The waypoint and position return functions implemented by selecting icons **120B** or **120C**, respectively, do not form part of the present invention but would be known to a person of skill in the art.

If, on the other hand the icon closest to cursor **130** relates to the next (i.e. deeper) menu level (a YES at step **250**), then the index N is incremented (step **255**) and the second level (N=2) of the hierarchical menu is displayed (step **220**) revealing a new set of selectable icons related to the icon closest to pointer **130**. Process flow then returns to step **225**. Thus, for the search function (icon **120A**) discussed above, the next menu level may consist of three further icons **120A**, **120B** and **120C**. The second-level icon **120A** may represent a 'filter' function to search between features currently in-view on the display **100** or 'world' features outside of the display area. The second-level icon **120B** may represent a 'category' function to search for features based on category (e.g. hospitals, parks, lakes, major highways, secondary highways, etc.). The second-level icon **120C** may represent an 'index' function to facilitate searching through an alphabetical list using fine and

coarse-grained controls, as set forth for example in a PCT application filed at the Canadian Receiving Office on Mar. 11, 2005, by Redsky Mobile Inc., entitled Restricted User Interface Navigation.

Of course, rather than representing search, waypoint and location return functions, as set forth above, the icons **120** may represent any context-sensitive functions or features. For example, if the pointer **130** is adjacent an area of interest (e.g. a restaurant) after a period of controller inactivity following panning of the map (a YES decision at step **215**), the icons **120** for the first level of the menu may represent user functions associated with the area of interest. Thus, where the device is a wireless communications device with GPS functionality, icon **120A** may represent, for example, a restaurant menu, icon **120B** may initiate a wireless phone call to the restaurant (e.g. to make a reservation), and **120C** may, as before, depict a 'U-turn' graphic for causing the map to return to the GPS current location. A person of skill in the art will appreciate that there are numerous context-sensitive functions and menu hierarchies, all of which are navigable using the methodology presented herein.

Therefore, as set for the herein, a user is able, by simple operation of the two-dimensional controller **110**, to navigate multiple (i.e. nested) levels of a hierarchical menu system and to select or initiate specific context-sensitive functions with only one hand. Moreover, the menu system may be navigated without interfering with a primary function of the electronic device.

The present specification describes an implementation that employs GPS positioning. As discussed above, the principles set forth herein are not restricted to GPS-enabled devices (or any other location-enabled devices, such as cellular devices with location determined via triangulation, Bluetooth or other short-range location-enabled devices, etc.). Rather, this specification is directed to a system and method for navigating hierarchical menu systems with a two-dimensional controller, irrespective of the application. It is envisaged that a person of ordinary skill in the art, in view of the present specification and drawings, could adapt the present techniques to operate with other controllers than a two-dimensional controller. For example, a roller wheel and an auxiliary input could be combined to provide a two-dimensional controller whereby when the roller wheel is actuated independent of the auxiliary input the roller wheel controls one dimension, and when the roller wheel is actuated in conjunction with the auxiliary input the roller wheel controls another dimension. Such adaptations fall within the contemplated scope of the techniques taught by this specification and drawings.

Many features and advantages will be apparent from this specification and, thus, it is intended by the appended claims to cover all such features and advantages. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to impose any limit to the exact construction and operation illustrated and described herein, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the claims.

What is claimed is:

1. A method for navigating a multi-hierarchical menu system using a two-dimensional controller, comprising:
    detecting a dimension of initial operation of said two-dimensional controller;
    displaying responsive to said detection topmost level of said multi-hierarchical menu system having a plurality of icons in proximity to a pointer on a portion of a display, said icons being displayed over a background image and horizontally if said detected dimension of

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initial operation of said two-dimensional controller is horizontal and vertically if said detected dimension of initial operation of said two-dimensional controller is vertical;

scrolling said icons in a first dimension relative to said pointer responsive to operating said controller in said first dimension; and

selecting one of said icons responsive to operating said controller in a second dimension.

2. The method of claim 1, wherein said selecting initiates one of either execution of a function associated with said one of said icons or displaying a next level of said multi-hierarchical menu system associated with said one of said icons.

3. The method of claim 1, wherein said second dimension is perpendicular to said first dimension.

4. The method of claim 1, wherein said topmost level of said multi-hierarchical menu system is displayed following a predetermined period of inactivity of said controller.

5. The method of claim 1, wherein said icons represent context-sensitive functions.

6. The method of claim 5, wherein said context-sensitive functions include at least one of searching for information relating to a feature of interest in proximity to said pointer, setting a location waypoint, and returning to a current location.

7. The method of claim 2, wherein said next level of said multi-hierarchical menu system includes a plurality of additional icons representing further functions related to said one of said icons.

8. The method of claim 7, wherein said further functions include at least one of a filter function to search between features currently in-view on said display and features outside of the display area, a category function to search for features based on categories, and an index function to facilitate searching through an alphabetical list using fine and coarse-grained controls.

9. The method of claim 1, further comprising ceasing display of said multi-hierarchical menu system responsive to scrolling said icons beyond a last one of said icons.

10. A system for navigating a multi-hierarchical menu system of a device having a primary function, comprising:

a display;

a two-dimensional controller for facilitating control of said primary function, whereupon results of said primary function are presented on said display; and

a processor for (i) executing said primary function, (ii) detecting a dimension of initial operation of said two-dimensional controller, (iii) causing display responsive to said detection of an topmost level of said multi-hierarchical menu system having a plurality of icons in proximity to a pointer on a portion of a display, said icons being displayed over a background image and horizontally if said detected dimension of initial operation of said two-dimensional controller "is horizontal and vertically if said detected dimension of initial operation of said two-dimensional controller is vertical", (iv) scrolling said icons in a first dimension relative to said pointer responsive to operating said controller in said first dimension, and (v) selecting one of said icons responsive to operating said controller in a second dimension.

11. The system of claim 10, wherein said processor selectively initiates one of either execution of a function associated with said one of said icons or displaying a next level of said multi-hierarchical menu system associated with said one of said icons.

12. The system of claim 10, wherein said second dimension is perpendicular to said first dimension.

13. The system of claim 10, wherein said processor causes display of said topmost level of said multi-hierarchical menu system following a predetermined period of inactivity of said controller.

14. The system of claim 10, wherein said icons represent context-sensitive functions.

15. The system of claim 14, wherein said context-sensitive functions include at least one of searching for information relating to an area of interest in proximity to said pointer, setting a location waypoint, and returning to a current location.

16. The system of claim 11, wherein said next level of said multi-hierarchical menu system includes a plurality of additional icons representing further functions related to said one of said icons.

17. The system of claim 16, wherein said further functions include at least one of a filter function to search between features currently in-view on said display and features outside of the display area, a category function to search for features based on categories, and an index function to facilitate searching through an alphabetical list using fine and coarse-grained controls.

18. The system of claim 10, wherein said controller ceases display of said multi-hierarchical menu system responsive to scrolling said icons beyond a last one of said icons.

19. A method for navigating a multi-hierarchical menu system using a two-dimensional controller, comprising:

detecting a dimension of initial operation of said two-dimensional controller;

displaying responsive to said detection topmost level of said multi-hierarchical menu system having a plurality of icons in proximity to a pointer on a portion of a display, said icons being displayed over a background image and horizontally if said detected dimension of initial operation of said two-dimensional controller "is horizontal and vertically if said detected dimension of initial operation of said two-dimensional controller is vertical";

scrolling said icons in a first dimension relative to said pointer responsive to operating said controller in said first dimension; and

selecting one of said icons in closest proximity to said pointer responsive to operating said controller in a second dimension.

20. The method of claim 19, wherein said selecting initiates one of either execution of a function associated with said one of said icons or displaying a next level of said multi-hierarchical menu system associated with said one of said icons.

21. The method of claim 19, wherein said second dimension is perpendicular to said first dimension.

22. The method of claim 19, wherein said topmost level of said multi-hierarchical menu system is displayed following a predetermined period of inactivity of said controller.

23. The method of claim 19, wherein said icons represent context-sensitive functions.

24. The method of claim 23, wherein said context-sensitive functions include at least one of searching for information relating to a feature of interest in proximity to said pointer, setting a location waypoint, and returning to a current location.

25. The method of claim 20, wherein said next level of said multi-hierarchical menu system includes a plurality of additional icons representing further functions related to said one of said icons in closest proximity to said pointer.

26. The method of claim **25**, wherein said further functions include at least one of a filter function to search between features currently in-view on said display features outside of the display area, a category function to search for features based on categories, and an index function to facilitate searching through an alphabetical list using fine and coarse-grained controls.

27. The method of claim **19**, further comprising ceasing display of said multi-hierarchical menu system responsive to scrolling said icons beyond a last one of said icons.

28. A system for navigating a multi-hierarchical menu system of a device having a primary function, comprising:

a display;

a two-dimensional controller for facilitating control of said primary function, whereupon results of said primary function are presented on said display; and

a processor for (i) executing said primary function, (ii) detecting a dimension of initial operation of said two-dimensional controller (iii) causing display responsive to said detection of topmost level of said multi-hierarchical menu system having a plurality of icons in proximity to a pointer on a portion of a display, said icons being displayed over a background image and horizontally if said detected dimension of initial operation of said two-dimensional controller "is horizontal and vertically if said detected dimension of initial operation of said two-dimensional controller is vertical", (iv) scrolling said icons in a first dimension relative to said pointer responsive to operating said controller in said first dimension, and (v) selecting one of said icons in closest proximity to said pointer responsive to operating said controller in a second dimension.

29. The system of claim **28**, wherein said processor selectively initiates one of either execution of a function associated with said one of said icons or displaying a next level of said multi-hierarchical menu system associated with said one of said icons.

30. The method of claim **28**, wherein said second dimension is perpendicular to said first dimension.

31. The system of claim **28**, wherein said processor causes display of said topmost level of said multi-hierarchical menu system following a predetermined period of inactivity of said controller.

32. The system of **28**, wherein said icons represent context-sensitive functions.

33. The system of claim **32**, wherein said context-sensitive functions include at least one of searching for information relating to an area of interest in proximity to said pointer, setting a location waypoint, and returning to a current location.

34. The system of claim **29**, wherein said next level of said multi-hierarchical menu system includes a plurality of additional icons representing further functions related to said one of said icons in closest proximity to said pointer.

35. The system of claim **34**, wherein said further functions include at least one of a filter function to search between features currently in-view on said display features outside of the display area, a category function to search for features based on categories, and an index function to facilitate searching through an alphabetical list using fine and coarse-grained controls.

36. The system of claim **28**, wherein said controller ceases display of said multi-hierarchical menu system responsive to scrolling said icons beyond a last one of said icons.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 4, line 22, delete "for the" and insert -- forth --

In column 5, line 55 claim 10, delete ""is" and insert -- is --

In column 5, line 57 claim 10, delete "vertical"" and insert -- vertical --

In column 6, line 37 claim 19, delete ""is" and insert -- is --
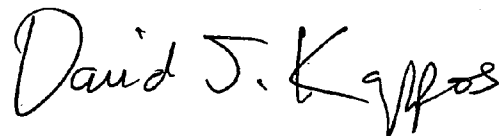
In column 6, line 40 claim 19, delete "vertical"" and insert -- vertical --

In column 7, line 26 claim 28, delete ""is" and insert -- is --

In column 7, line 28 claim 28, delete "vertical"" and insert -- vertical --

Signed and Sealed this

Twenty-second Day of June, 2010

David J. Kappos
Director of the United States Patent and Trademark Office