Title: METHOD AND APPARATUS FOR LARGE SCREEN INTERACTIVE CONTROL USING PORTABLE TOUCHSCREEN DEVICE

Abstract: A method and apparatus for providing inactive control of information on a remotely located screen though a portable device is disclosed. The method comprises the steps of establishing a reference orientation (320) between a remotely located screen (110) and the portable device (120), the reference being associated with selected information located on the remotely located screen (110), monitoring movement (330) of the portable device (110) with regard to the reference orientation, said monitoring associating information (130) located on the remotely located screen (110), and displaying the associated information (125) on the portable device (120).
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METHOD AND APPARATUS FOR LARGE SCREEN INTERACTIVE CONTROL USING PORTABLE TOUCHSCREEN DEVICE

This invention relates to the field of interactive devices and more particularly to the use of portable devices for controlling the interaction with a remote large screen device.

Interaction with big screens at a distance beyond hand reachability is problematic. It has been demonstrated in a number of studies that pointing devices, e.g., laser pointers, remote controls with embedded joysticks or trackball, demonstrate poor user performance. The responses are slow, imprecise and error-prone. See for example, "Interacting at a Distance Using Semantic Snarfmg," Myers, Brad, et. al, Proceedings of Ubicomp 2001, Sept 30-Oct 2, Atlanta, Georgia, pp. 305-314.

In these studies, a portable device used for controlling the user interface (UI) on a large screen performed significantly better in terms of user performance, faster movement time and a bigger throughput. A portable device further scored better on subjective user rating of ease of use and user preference.

The interaction technique suggested by Myers combines a pointing device, like a laser pointer, with interaction on a remote screen, such as that of a Personal Digital Assistant (PDA). In this technique the pointing device is used for user tasks that do not require accuracy in pointing, e.g., accuracy required for relatively small target selection on a large screen. Pointing in this technique is used for the rough area of interest selection and the rough area is displayed on the portable screen. The portable screen is then used for detailed tasks requiring accuracy in target acquisition, e.g., selecting user-interface (UI) options, interacting with menus, etc.

The technique further describes panning with a coarse-grain pointing where the laser pointer is used for an indication of the approximate area of interest and then subsequently tapping on the portable touch screen as if the user were tapping on the remote larger screen itself. In this manner all target activations on the remote screen are also reflected in selections made on the large screen. This solution has limitations in that the user has to share his visual attention between the large screen to select the area of interest and the portable screen for accurate interaction.
It is predicted that as the number of functions in Multimedia Home personal computers (PC) increases a traditional remote control used in combination with a jumping highlight interaction pattern will not suffice. Alternative pointing solutions will be needed to support user interfaces with rich, interactive content. Some applications, like Internet browsing, will be accessible in the living room. However, they are created for desktop mouse-keyboard interaction. One possibility is to create new guidelines and force content providers to supply an extra version of their Web application for the living room that can be controlled using a jumping highlight interaction stylist. Another alternative is to find a suitable input device that would replace a mouse and a keyboard in the living room to support already existing Web applications and other applications traditionally designed for a PC. Similarly, in computer gaming the social elements of the game adds to the enjoyment of the players. In strategy games several views are usually in use (global, geographical, and player specific).

Hence, there is a need in the industry for a method and apparatus to provide for accurate control of remotely located large screens.

A method and apparatus for providing inactive control of information on a remotely located screen though a portable device is disclosed. The method comprises the steps of establishing a reference orientation between the remotely located screen and the portable device, the reference being associated with selected information located on the remotely located screen, monitoring movement of the portable device with regard to the reference orientation, said monitoring associating information located on the remotely located screen, and displaying the associated information on the portable device.

Figure 1 illustrates an exemplary large screen/PDA controller;
Figure 2 illustrates an exemplary method for providing remote control in accordance with the principles of the invention; and
Figure 3 illustrates a flow chart of an exemplary process for providing control function in accordance with the principles of the invention.

It is to be understood that these drawings are for purposes of illustrating the concepts of the invention and are not to scale. It will be appreciated that the same reference numerals, possibly supplemented with reference characters where appropriate, have been used throughout to identify corresponding parts.
Figure 1 illustrates an exemplary remote large screen/PDA controller. In this illustrated example, large screen 110 displays a well-known computer menu, similar to that displayed under the WINDOWS operating system or the MacOS operating system. WINDOWS is a registered trademark of the Microsoft Corporation and MacOS is a registered trademark of APPLE Corporation. For example, the first line includes illustrated primary operations "File," "Edit," "Tools." Each of these primary operations, when selected, displays a pull-down menu that provides access to further operations, e.g., "Undo," "Cut," "Copy," "Delete, etc."

Also shown is portable device, e.g., PDA, 120 including a display screen 125 that includes selected information associated with the information on screen 110. In this case, the information on display screen 125 is contained within an area 130 on large screen 110. Portable device 120 and large screen 110 may be in communication using well-known RF, infrared or optical wireless or wired communication media, e.g., point-to-point or networked Internet or Intranet. For example, the communication media may use well-known IEEE 802.11b/g/n or BLUETOOTH protocols. Such wireless and wired communication protocols are well-known and need not be discussed in detail herein. Information between device 120 and screen 110 may pass through a not shown device, e.g., a personal computer, to provide information to large screen 110.

Figure 2 illustrates an exemplary means for providing remote control operation in accordance with the principles of the invention. In this illustrated case, panning control may be initiated by tilting or rotating the body of portable device 120. Tilting can be initiated, in one aspect, by touching the casing of device 120 with both hands, hence, making contact with two opposite sides of the portable device 120. Alternatively, the user can switch on a physical switch putting the device 120 into the titling mode. Activation of the tilting mode establishes a reference orientation used for subsequent relative angular movement detection. The reference orientation establishes at least one parameter relating the large screen and the small screen device. Such parameters may, for example, represent distance, pointing angle, spatial orientation, etc. As the user tilts or moves the portable device 120 around two axes 210 and 220, the orientation of device 120, at sufficient intervals, is compared with the reference orientation to determine the direction and rate of panning. The rate of scrolling is controlled as a function of the amount of tilt between the orientation of the device and the reference
orientation. Tilting the portable device 120 results in both horizontal and vertical translation of the area 130 (referred to as a virtual window) on large screen 100 relative to its reference position. Substantially and concurrently, the image displayed on display screen 125 is updated and displays part of the image corresponding to the area 130 visible on large screen 110.

To detect tilting or movement of device 120 different sensors and sensor combinations can be used. For example, inclinometers, gyroscopes, magnetic compasses, etc., may be used to determine tilt and consequentially the position or orientation for a reference point of device 120. In the tilting mode, additional feedback can be displayed on the large screen 110 signifying direction of moving area 130 and the current direction of movement resulting from tilting the portable device 120.

In another aspect, the user may scale the information displayed by zooming-in or zooming-out the area 130. In this aspect of the invention, software zoom control may be implemented by a slider, a "plus-minus" control, a wheel, mouse, touch pad, joystick, or finger-controlled mouse function. The slider, for example, may be a software slider positioned either vertically or horizontally around or within display area 125 or may be, preferably, a physical slider positioned within the casing of portable device 120.

Figure 3 illustrates a flow chart of an exemplary process 300 for determining and controlling the movement of the portable device in accordance with the principles of the invention. In this exemplary process, a determination is made at block 310, whether tilt mode is activated. If the answer is negative, then processing continues until tilt mode is initiated.

When tilt mode is determined, the current device orientation is determined and used as a reference at block 320. The reference includes the portable device orientation and its relationship with the information displayed remotely on the large screen 110, e.g., in area 130. At block 330, movement of the portable device is monitored. As previously discussed, the movement may be determined by gyroscopes, accelerometers, etc. At block 340, a difference between the reference orientation and the current orientation is determined. At block 350, the determined difference is associated with a screen location. At block 360, information associated with the screen location is displayed on a display screen within portable device. At block 370, a determination is made whether movement of the portable device is continuing. If the answer is in the affirmative, then processing continues at block 330. Otherwise, processing is completed.
As would be appreciated, the processing shown herein may be executed by software and/or hardware code operating in a computer or processing system. The system may include a programmable memory, i.e., PROM, RAM, FLASH, etc., that stores code that provides necessary instructions to the processing system. The code may pre-stored in the memory or may be downloaded via one or more computer-readable media or over a network. In another aspect, the code may be a hardware code loaded in a FPGA or ASIC that provides necessary instructions to the processing system. The processing system may further receive inputs from one or more sensors that provide indications of the movement of the portable device.

While there has been shown, described, and pointed out fundamental novel features of the present invention as applied to preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the apparatus described, in the form and details of the devices disclosed, and in their operation, may be made by those skilled in the art without departing from the spirit of the present invention.

It is expressly intended that all combinations of those elements that perform substantially the same function in substantially the same way to achieve the same results are within the scope of the invention. Substitutions of elements from one described embodiment to another are also fully intended and contemplated.
CLAIMS:

1. A method for providing interactive control of information on a remotely located screen through a portable device, the method comprising the steps of:
   establishing a reference orientation (320) between the remotely located screen (110) and the portable device (120), the reference being associated with selected information located on the remotely located screen (110);
   monitoring movement (330) of the portable device (120) with regard to the reference orientation, said monitoring associating information (130) located on the remotely located screen (110); and
   displaying (125) the associated information (130) on the portable device (120).

2. The method as recited in claim 1, further comprising the step of:
   representing an area (130) on the remotely located screen (110) corresponding to the information displayed (125) on the portable device (120).

3. The method as recited in claim 1, further comprising the step of:
   establishing the reference in response to a manual operation (310) of the portable device (120).

4. The method as recited in claim 2, further comprising the step of:
   altering the size of the area on the remotely located screen from the portable device.

5. The method as recited in claim 1, wherein movement of the portable device is determined from a device selected from the group consisting of: gyroscopes, inclinometers, magnetic compass and accelerometers.

6. An apparatus for providing interactive control of information on a remotely located screen, the apparatus comprising:
   a processor executing code for:
establishing a reference orientation between remotely located screen (110) and the portable device (120), the reference being associated with selected information located on the remotely located screen (110);

monitoring movement (330) of the portable device with regard to the reference orientation, said monitoring associating information (130) located on the remotely located screen (110); and

displaying (125) the associated information on the portable device (120).

7. The apparatus as recited in claim 6, wherein the processor executes code for: representing an area on the remotely located screen corresponding to the information displayed on the portable device.

8. The apparatus as recited in claim 6, wherein the processor executes code for: establishing the reference in response to a manual operation of the portable device.

9. The apparatus as recited in claim 7, wherein the processor executes code for: altering the size of the area on the remotely located screen from the portable device.

10. The apparatus as recited in claim 6, further comprising:
a movement detection device, in communication with the processor, selected from the group consisting of: gyroscopes, inclinometers, magnetic compass and accelerometers.

11. A computer program product including computer code loadable into a memory of an apparatus, said apparatus providing interactive control of information on a remotely located screen, the computer code providing instruction to a processor included in the apparatus for executing the steps of:
establishing a reference orientation between the remotely located screen and the portable device, the reference being associated with selected information located on the remotely located screen;
monitoring movement of the portable device with regard to the reference orientation, said monitoring associating information located on the remotely located screen; and
displaying the associated information on the portable device.

12. The computer program product as recited in claim 11, wherein the computer code
    providing instruction to the processor for executing the step of:
    representing an area on the remotely located screen corresponding to the information
displayed on the portable device.

13. The computer program product as recited in claim 11, wherein the computer code
    providing instruction to the processor for executing the step of:
    establishing the reference in response to a manual operation of the portable device.

14. The computer program product as recited in claim 12, wherein the computer code
    providing instruction to the processor for executing the step of:
    altering the size of the area on the remotely located screen from the portable device.

15. The computer program product as recited in claim 11, wherein the computer code
    providing instruction to the processor for executing the step of:
    communicating with a movement detection device selected from the group consisting
    of: gyroscopes, inclinometers, magnetic compass and accelerometers.