

20 DEC 1996

SC0589AH

-1-

A PORTABLE ELECTRONIC DEVICE

Field of the Invention

5 This invention relates to a portable electronic device, and particularly to a portable electronic device having a display, and a method for displaying information on the display according to a reference orientation and irrespective of the orientation of the device.

10 Background of the Invention

Portable electronic devices such as note book computers, personal digital assistants (PDAS), personal organisers, and portable communication equipment have a display to display information for a user.

A difficulty with the conventional display on portable devices is that the displayed information has only one orientation. Consequently, when the orientation of the portable device is changed, the orientation of the displayed information is also changed and may no longer be conveniently viewed by a user.

For example, when a user of a display pager wants to view information displayed on the pager, the user has to orientate the pager according to the one orientation.

2 5 There is a known method of providing a display having a user selectable display orientation which allows the user to select one of several display orientations. However, a disadvantage of this method is that it requires the user to provide an input to indicate the desired orientation of the displayed information.

30 Brief Summary of the Invention

The present invention therefore seeks to provide a device having a display which overcomes, or at least reduces the above-mentioned problem of the prior art.

100-100000

Accordingly, in one aspect the present invention provides a device comprising: a detector for detecting the orientation of the device and providing an output signal indicating the orientation of the device; a controller coupled to receive the output signal from the detector and coupled to receive information, the controller including a comparator for comparing the output signal with a reference orientation signal to produce a difference signal, a processor coupled to the comparator for processing the information using the difference signal to produce the information orientated according to the reference orientation; a display coupled to the controller for displaying the information.

In another aspect the present invention provides a method comprising the steps of: providing information for display on a device; detecting the orientation of the device; comparing the orientation of the device with a reference orientation to produce a difference in orientations; processing the information using the difference in orientations to produce the information having the reference orientation; and displaying the processed information.

Brief Description of the Drawings

An embodiment of the invention will now be more fully described, by way of example, with reference to the drawings, of which:

FIG. 1 shows a schematic of a portable device;

FIG. 2 shows the portable device in FIG. 1 orientated according to a reference orientation and displaying information orientated according to the reference orientation;

FIG. 3 shows a portable device according to the prior art vertically inverted;

FIG. 4 shows the portable device in FIG. 1 vertically inverted and displaying the information orientated according to the reference orientation;

FIG. 5 shows a portable device according to the prior art orientated at an angle to the reference orientation; and

FIG. 6 shows the portable device in FIG. 1 orientated at an angle to the reference orientation and displaying the information orientated according to the reference orientation.

Detailed Description of the Drawings

In FIG. 1 the portable device 5 includes an accelerometer 10 coupled to a controller 15. The controller 15 is also coupled to a display driver 35, an input 13, and a touchscreen liquid crystal display 40. In addition, the display driver 35 is coupled to the display 40.

The controller 15 includes a comparator 20 which is coupled to the output of the accelerometer 10. The comparator 20 is also coupled to a memory 25. The output of the comparator 20 is coupled to a processor 30. The processor 30 is coupled to the input 13 and provides an output to the display driver 35.

The accelerometer 10 is made by Motorola Inc. of the United States of America, model MMAS40G10S, and provides an output voltage which changes according to changes in its orientation relative to the force of gravity, thus providing an indication of its orientation. The accelerometer 10 is operated on a five volt direct current power supply. This allows the accelerometer 10 to detect the force of gravity within the range of $\pm 1G$. Consequently, a resolution of $0.1G$ translates to 0.25 volts. Using an eight bit analogue to digital converter (ADC) results in 255 voltage steps, with each step having a sensitivity of 0.0196 volts. Hence, $0.1G$ translates to a value of 13 steps, i.e. binary 1101.

The output of the accelerometer 10 indicates its orientation, and with the accelerometer 10 secured in the device 5 the output of the accelerometer 10 provides an indication of the orientation of the device 5. The device 5 is calibrated to have a reference orientation by aligning it with the force of gravity, and storing the value of the output signal from the accelerometer 10. This value is used as a reference orientation value, and the value of all subsequent outputs from the accelerometer 10 are compared to the reference orientation value by the comparator 20.

The reference orientation value is stored in the memory 25, and whenever the comparator 20 makes a comparison, the reference orientation value stored in the memory 25 is provided to the comparator 20.

The comparator 20 compares the value of the output signal from the detector 10 with the reference orientation value, and provides an output signal indicating the difference in orientations to the processor 30. The processor 30 is also coupled to receive
5 information for display on the display 40 from an input 13, and processes the information using the difference in orientations such that the information is orientated according to the reference orientation when displayed on the display 40. One method of accomplishing this is to invert the difference in orientations and
1 0 processing the information to have the inverted orientation when the information is displayed on the display 40.

The processor 30 provides the processed information to the LCD driver 35 which converts the processed information into a form suitable for driving the LCD display 40.

1 5 In response to receiving the output from the LCD driver 35, the display 40 displays the information. The display 40 includes a touch screen which allows a user to provide input to the controller 15. The touch screen operates by displaying user selectable input selectors 210 at different locations on the display 40. The controller 15
2 0 determines the options selected by the user by detecting the locations on the screen that are touched by the user.

In FIG. 2 both displayed information 205 and the device 5 are orientated according to the reference orientation. The displayed information 205 includes displaying input selectors 210 on the touch
2 5 screen display 40.

In FIG. 3 a prior art device with the same displayed information 205 is vertically inverted. Consequently, as the displayed information 205 has only one orientation, the displayed information 205 is also inverted.

3 0 In FIG. 4 the device 5 is vertically inverted by a 180 degree. The detector 10 detects the new orientation of the device 5 and provides an output signal to the comparator 20. The output signal has a value indicating the new orientation, and the comparator 20 compares the value of the output signal to the reference orientation
3 5 value stored in the memory 25.

In response, the comparator 20 produces the difference signal indicating the difference between the orientation of the device and the

reference orientation, and provides the difference signal to the processor 30. In this instance the difference signal indicates a difference of 180 degrees from the reference orientation.

5 The processor 30 processes the information received from the input 13 using the difference signal, and produces the displayed information 205 according to the reference orientation.

In FIG. 5 a prior art device displaying the same information 205 is orientated at an angle to the reference orientation. Consequently, as the displayed information 205 has only one orientation, the
10 displayed information 205 is also inverted.

In FIG. 6 the device 5 is orientated at an angle to the reference orientation. The detector 10 detects the new orientation of the device 5 and provides an output signal to the comparator 20. The output signal has a value indicating the new orientation, and the comparator
15 20 compares the value of the output signal to the reference orientation value stored in the memory 25.

In response, the comparator 20 produces a difference signal indicating the difference between the orientation of the device 5 and the reference orientation, and provides the difference signal to the
20 processor 30. In this instance the difference signal indicates an acute angle i.e. an angle of less than 90 degrees from the reference orientation.

The processor 30 processes the information received from the input 13 using the difference signal, and produces the displayed
25 information 205 which is orientated according to the reference orientation.

Hence, the present invention advantageously maintains the displayed information in a reference orientation on a display of a portable device when the orientation of the device is changed.

30 The device accomplishes this by having an accelerometer which detects the orientation of the device. This is then compared with a reference orientation to determine a change in orientation of the device. When a change is detected the orientation of information for display is changed such that the information is displayed according to the
35 reference orientation.

Hence, the described invention automatically changes the orientation of the displayed information on a portable device so that

the orientation of the displayed information is in accordance with the reference orientation, irrespective of the orientation of the device.



Claims

1. A device comprising:
 - 5 a detector for detecting the orientation of the device and providing an output signal indicating the orientation of the device;
a controller coupled to receive the output signal from the detector and coupled to receive information, the controller including a
10 comparator for comparing the output signal with a reference orientation signal to produce a difference signal, a processor coupled to the comparator for processing the information using the difference signal to produce the information orientated according to the reference orientation;
15 a display coupled to the controller for displaying the information.
2. A device according to claim 1 further comprising a memory
20 coupled to the comparator for storing the reference orientation signal.
3. A device according to claim 1 wherein the detector comprises a sensor for detecting the orientation of the device relative to the reference orientation.
25
4. A device according to claim 3 wherein the detector comprises a sensor for detecting the orientation of the device relative to the direction of gravity.
- 30 5. A device according to claim 4 wherein the sensor comprises an accelerometer.
6. A device according to any one of the preceding claims wherein the device further comprises an input means coupled to the controller
35 for providing user input, the input means having input selectors displayed on the display, wherein the location of the input selectors



This Sheet Has Been Replaced



on the display changes in accordance with changes in the orientation of the displayed information.

5 7. A device according to any one of the preceding claims wherein the display comprises a touch screen liquid crystal display.

8. A method comprising the steps of:

10 a) providing information for display on a device;

b) detecting the orientation of the device;

15 c) comparing the orientation of the device with a reference orientation to produce a difference in orientations;

d) processing the information using the difference in orientations to produce the information having the reference orientation; and

20 e) displaying the processed information.

9. A method according to claim 8 wherein a step prior to step (b) comprises the step of detecting the reference orientation.

25 10. A method according to claim 9 wherein the step prior to step (b) comprises the step of detecting the direction of gravity.