

[0019] FIGS. 8A through 8D are diagrams illustrating use of a small control panel on the touch screen associated with an application, reserving the entire main display for visual data associated with the application;

[0020] FIG. 9 is a diagram showing an example use of the touch screen to display subsidiary help text;

[0021] FIG. 10A is a diagram illustrating employment of the touch screen to display a find/replace dialog on the touch screen, leaving the main display free to display a document unobstructed;

[0022] FIG. 10B is a diagram illustrating use of the touch screen to act as a joystick emulator while displaying the control layout established by the game, leaving the main display free to display game graphics unobstructed;

[0023] FIG. 10C is a diagram illustrating an example in which a touch screen image includes icons drawn from a typical toolbar, leaving the main display free to display document or an image unobstructed;

[0024] FIG. 11 is a diagram illustrating a pop-up image including various icons representing commonly used tools and software applications on the computer;

[0025] FIG. 12 is a diagram illustrating a pop-up calculator application that operates entirely within the touch screen;

[0026] FIGS. 13A and 13B are diagrams illustrating different features of a magnifier as a pop-up image on a touch screen, leaving the main display undisturbed;

[0027] FIG. 13C is a diagram illustrating a debugger implemented as a pop-up application on a touch screen, providing a secondary debugging display with no extra cost or bulk;

[0028] FIG. 14 is a diagram illustrating an example of an ideographic handwriting entry system on a touch screen in which a handwriting entry area responds to finger touch to enter an ideographic character;

[0029] FIG. 15A is a diagram illustrating use of a touch screen as a user interface device for a computer security interlock;

[0030] FIG. 15B is a diagram illustrating an exemplary hardware architecture for implementing the computer security interlock of FIG. 15A; and

[0031] FIG. 16 is a diagram illustrating an exemplary software architecture for a touch screen.

DETAILED DESCRIPTION

[0032] Those of ordinary skill in the art will realize that the following description of the present invention is illustrative only and not in any way limiting. Other embodiments of the invention will readily suggest themselves to such skilled persons.

[0033] FIG. 1 illustrates a notebook computer system 100 with main display 102 and keyboard 104. Touch screen 106 is mounted in palm rest 110. The touch screen is typically equipped with left and right "mouse" buttons 108. Touch screen 106 is integrated into computer system 100 in a similar way as a touch pad would be in a prior art computer. Touch screen 106 will usually be located in the palm rest as

shown in FIG. 1, but other locations are equally applicable, such as above the keyboard, adjacent to the keyboard or main display, or located in a separate enclosure connected by cable or wireless link to the computer. Although touch screen 106 usually replaces the conventional touch pad of a computer, touch screen 106 could be introduced in addition to the other user interface devices of the computer.

[0034] FIG. 2 illustrates an illustrative embodiment of touch screen 106 in greater detail. Touch screen assembly 200 consists of touch sensor 202, display 204, and backlight 206 stacked or laminated together. Touch screens can be built in a variety of alternative ways as are well known in the art. For example, touch sensor 202 can be an active sensor employing capacitive, resistive, inductive, or other methods, or it can be a passive surface on which touch sensing is accomplished by optical, acoustic, or other methods. Capacitive touch sensors are ideally suited for use in the present invention due to their sensitivity, low cost, ruggedness, and suitability to small sensing areas. However, any touch screen technology would serve for the present invention.

[0035] Similarly, display 204 can be a liquid crystal display (LCD), organic light emitting diode (OLED) display, electroluminescent display, or any other type of small display suitable for mounting in a portable computer. LCD displays are ideally suited for use in the present invention due to their low cost and availability, but other types of displays may be employed. Display 204 may be color or monochrome, and need not have the same resolution, color capabilities, or other qualities as the main display of the computer.

[0036] The touch screen assembly may include a backlight 206 to enhance readability in all lighting conditions. In alternative embodiments, backlight 206 may be replaced by a frontlight, passive reflector, or other light source, or it may be omitted altogether.

[0037] Touch screen assembly 200 may include additional layers or components to assist the mounting or mechanical properties of the touch screen or to integrate the touch screen with other components of the computer system. The touch screen may also include hardened, antireflective, textured, or other surface layers. The inclusion, omission, or nature of these additional layers and components is immaterial to the present invention.

[0038] Touch sensor 202 is connected to touch sensing controller 208. The nature of controller 208 depends on the design of touch sensor 202 and its details are immaterial to the present invention. Likewise, display 204 is connected to a suitable display controller 210, and backlight 206, if present, is connected to backlight controller 212. Each of controllers 208, 210, and 212 communicate with host computer 214. In an illustrative embodiment, controllers 208, 210, and 212 are connected to a central touch screen controller 216 that connects to host computer 214 by a single interface 218. Interface 218 may be a mouse interface such as PS/2, or a general purpose peripheral interface such as the Universal Serial Bus (USB). USB has the advantage of high bandwidth and wide availability. Any of controllers 208, 210, 212, and 216 may be implemented as chips or discrete components, combined onto fewer chips or one chip, integrated with assembly 200, or combined with other functions of host computer 214. Host computer 214 may be embodied