

the device. In some embodiments, a virtual click wheel is displayed on the touch screen of a portable electronic device and operated by user contact with the touch screen. In other embodiments, a virtual click wheel is displayed on a computer screen and operated with a mouse, touch pad, or other pointing device.

[0037] The device 100 also includes a power system 162 for powering the various components. The power system 162 may include a power management system, one or more power sources (e.g., battery, alternating current (AC)), a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator (e.g., a light-emitting diode (LED)) and any other components associated with the generation, management and distribution of power in portable devices.

[0038] The device 100 may also include one or more optical sensors 164. FIG. 1 shows an optical sensor coupled to the peripherals interface 118. The optical sensor 164 may include charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) phototransistors. The optical sensor 164 receives light from the environment, projected through one or more lens, and converts the light to data representing an image. In conjunction with an imaging module (not shown), the optical sensor 164 may capture still images or video.

[0039] In some embodiments, the software components stored in memory 102 may include an operating system 126, a communication module (or set of instructions) 128, a contact/motion module (or set of instructions) 130, a graphics module (or set of instructions) 132, and one or more applications (or set of instructions) 136. The applications module 136 may include a telephone module (or set of instructions) 138, an address book module (or set of instructions) 140 and/or a memo pad module (or set of instructions) 142.

[0040] The operating system 126 (e.g., Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks) includes various software components and/or drivers for controlling and managing general system tasks (e.g., memory management, storage device control, power management, etc.) and facilitates communication between various hardware and software components.

[0041] The communication module 128 facilitates communication with other devices over one or more external ports 124 and also includes various software components for handling data received by the RF circuitry 108 and/or the external port 124. The external port 124 (e.g., Universal Serial Bus (USB), FIREWIRE, etc.) is adapted for coupling directly to other devices or indirectly over a network (e.g., the Internet, wireless LAN, etc.). In some embodiments, the external port is a multi-pin (e.g., 30-pin) connector that is the same as, or similar to and/or compatible with the 30-pin connector used on iPod (trademark of Apple Computer, Inc.) devices.

[0042] The contact/motion module 130 may detect contact with the click wheel 114 (in conjunction with the click wheel controller 158) and/or a touch screen in the display system 112 (in conjunction with the display controller 156). The contact/motion module 130 includes various software components for performing various operations related to detection of contact, such as determining if contact has occurred, determining if there is movement of the contact and tracking the movement across the click wheel 114 and/or a touch screen in the display system 112, and determining if the contact has been broken (i.e., if the contact has ceased). Determining movement of the point of contact may include

determining speed (magnitude), velocity (magnitude and direction), and/or an acceleration (a change in magnitude and/or direction) of the point of contact. In some embodiments, the contact/motion module 130 and the display controller 156 also detects contact on a touchpad.

[0043] The graphics module 132 includes various known software components for rendering and displaying graphics on the display system 112, including components for changing the intensity of graphics that are displayed. Note that the term "graphics" includes any object that can be displayed to a user, including without limitation text, web pages, icons (such as user-interface objects including soft keys), digital images, videos, animations and the like.

[0044] In addition to the telephone module 138, the address book module 140 and/or the memo pad module 142, the one or more applications 136 may include any applications installed on the device 100, including without limitation, a browser, email, instant messaging, text messaging, word processing, keyboard emulation, widgets, JAVA-enabled applications, encryption, digital rights management, voice recognition, voice replication, location determination capability (such as that provided by the Global Positioning System (GPS)), etc.

[0045] In conjunction with the RF circuitry 108, the audio circuitry 110, the speaker 111, the microphone 113, the display system 112, the display controller 156, the click wheel 114 and/or the click wheel controller 158, the telephone module 138 may be used to enter a sequence of characters corresponding to a telephone number, access one or more telephone numbers in the address book 144, modify a telephone number that has been entered, dial a respective telephone number, conduct a conversation and disconnect or hang up when the conversation is completed. The telephone module 138 may also be used to receive a second call while a first call is already ongoing, without disconnecting the first call, or conduct a conference call.

[0046] In conjunction with the display system 112, the display controller 156, the click wheel 114 and/or the click wheel controller 158, the address book module 140 may be used to manage address book data or contact list data 144, including adding a name, deleting a name, associating a telephone number or other information with a name, associating an image with a name, categorizing and sorting names, and so forth.

[0047] In conjunction with the display system 112, the display controller 156, the click wheel 114 and/or the click wheel controller 158, the memo pad module or other text application 142 may be used to enter text for storage in memory 102. In conjunction with the character sequence usage frequency tree 146, as text is entered in the memo pad module 142, character sequences may be provided as suggestions to the user in order to facilitate text entry, further details of which are described below.

[0048] The character sequence usage frequency tree 146, an exemplary conceptual diagram of which is shown in FIG. 4, stores usage frequencies for complete words and partial words in a tree data structure. The root node of the usage frequency tree 146 corresponds to an empty string. In the usage frequency tree, a first node is a child of a second node if the character sequence corresponding to the first node is the concatenation of the character sequence corresponding to the second node and one additional character. It should be appreciated that the preceding statement ignores the promotion of grandchildren nodes to children nodes, which is described