A HAND-HELD ELECTRONIC APPLIANCE AND METHOD OF ENTERING A SELECTION OF A MENU ITEM
A hand-held electronic appliance and method of entering a selection of a menu item

Description

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Field of the invention.

The present invention relates to the field of hand-held electronic appliances, such as mobile phones, smart phones, personal digital assistants (PDA), navigation systems, electronic cameras, digital photo viewers and multipurpose hand-held electronic appliances.

Background and prior art

Various hand-held electronic appliances which include an entry pen for a user's entry of commands or data are known from the prior art. For example, US Patent Number 6,667,740B2 shows a hand-held personal digital assistant (PDA) which includes an xy digitising system behind the PDA’s liquid crystal display which can sense the xy position of a resonant stylus. Further, a mobile telephone is disclosed that has a liquid crystal display, and sensor windings and excitation windings of a digitising system under the display. The digitising system is operable to sense the position of a resonant stylus relative to the display. The digitising system of the mobile telephone may be used to allow a user to create short text messages which can then be sent by the mobile
telephone to another party. If the mobile telephone includes an organiser, then the
digitiser can be used to control the inputting, manipulation and outputting of data from the
organiser.

In order to facilitate a user’s interaction some hand-held electronic appliances have a
graphical user interface for a user’s selections of icons of the graphical user interface by
means of an entry pen. Such prior art hand-held electronic appliances have resistive
interfaces that require that the entry pen is pressed against the surface of the display for a
user’s interaction. Examples for such prior art hand-held electronic appliances include
PDAs that are commercially available from PalmOne (www.palm1.com).

US Patent Number 6, 664,991 shows a user interface for a pen-based device that allows
users to activate the full "card" for an entry using a single tap whilst also giving the user
the ability to reach a menu of context dependent commands using a simple gesture. The
gesture consists of pressing and holding the stylus on a selection for a system-specified
length of time. If the user does not move the stylus more than a system-specified
distance from the original location for that time, a context menu gesture is recognised and
the application displays a context menu. Alternatively, pressing and holding an external
button on the pen-based device while an entry is highlighted is considered a context menu
gesture. As a further alternative double tapping the stylus or pressing and holding an
external button whilst tapping the stylus are considered context menu gestures.

**Summary of the invention**

In accordance with the invention there is provided a hand-held electronic appliance that
has graphical user interface means for displaying at least one context menu. The context
menu has a number of menu items. The hand-held electronic appliance has pen entry
means for contactless selection of one of the menu items. Further, the hand-held
electronic appliance has means for entering the selection.

The pen entry means for contactless selection can be implemented using capacitive and /
or inductive position sensing technologies. Such contactless position sensing
technologies are as such known from the prior art (e.g. EP 0 259 894 B1,EP 0307667 B1;
6,380,929 ).
The present invention is particularly advantageous as it facilitates a user's interaction with the hand-held electronic appliance. The user can select a menu item of a context menu without contacting the surface of the display which makes the user's interaction much more convenient. For example, the user can move the entry pen over the display while there is a gap between the surface of the display and the entry pen for convenient selection of a menu item within a context menu.

For entry of a menu item selection into the hand-held electronic appliance the user needs to perform an additional user entry action. For example, this entry can be performed by depressing the pen tip of the entry pen onto the surface of the display or by operating a switch of the entry pen. In the latter case both the selection of the menu item and entry of the selection can be performed without contacting the surface of the display with the entry pen.

In accordance with an embodiment of the invention at least one of the menu items of the context menu has an assigned context sub-menu. The graphical user interface displays the sub-menu in response to a contactless selection of the menu item to which the sub-menu is assigned.

In accordance with an embodiment of the invention the graphical user interface comprises an icon that represents the context menu. When the icon is selected by means of the entry pen, the context menu that is represented by the icon is displayed for the user's selection of the menu item.

Preferably, the graphical user interface comprises a number of context menus. The context menus provide selectable choices or options to a user in a stack of panes, with one choice being provided per pane. Each pane carries one menu item. The context menus are relatively small, with typically only a word or two of text being provided in each pane.

Preferably, the context menus are categorised. For example, there is one context menu for entering and / or viewing user settings, a context menu for communication functions, a context menu for organiser functions, a context menu for navigation functions, a context menu for digital camera functions and / or for other functionalities of the hand-held
electronic appliance. Each of the context menus can have one or more levels of sub-menus.

For example, the graphical user interface has a context manual for convenient dialling of telephone numbers. Each menu item represents a telephone number that is used relatively frequently by the user. A menu item can show a person's or organisation's name and/or the person's or organisation's telephone number. For convenient dialing the user selects one of the telephone numbers from the context menu and enters the selection. In response to the entry of the selection the selected number is called. Likewise email addresses or other communication links can be provided as menu items for convenient user selection.

The present invention is particularly advantageous for multi-function hand-held electronic appliances such as so-called smart phones that include an electronic organiser and/or other functionalities, such as a digital camera and/or a navigation system. The present invention facilitates a user's intuitive and ergonomic interaction with such complex hand-held electronic appliances.

**Brief description of the drawings**

In the following preferred embodiments of the invention will be described in greater detail, by way of example only, making reference to the drawings in with:

Figure 1 is a schematic top view of an embodiment of a hand-held electronic appliance of the invention,

Figure 2 is a perspective view of a position sensor illustrating electromagnetic coupling between the position sensor and the entry pen,

Figure 3 shows the hand-held electronic appliance of figure 1 after a user's selection of a menu item,

Figure 4 shows a block diagram of a more detailed embodiment of the hand-held electronic appliance,

Figure 5 is a flow diagram showing a preferred mode of operation of the hand-held electronic appliance of figure 4,
Figure 6 is a perspective view showing an embodiment of the configuration of the position-detecting system of the hand-held electronic appliance of figure 4,

Figure 7 is a flow chart illustrating an embodiment of the method of the invention.

Detailed Description

Figure 1 shows a schematic view of the hand-held smartphone 100. The smartphone 100 has about the size of a palm and is battery powered. It has a wireless interface to a digital cellular communication network, such as a GSM, UMTS, CDMA, WLAN or other kind of wireless network. By means of the wireless interface a user can make phone calls, send email and / or connect to the Internet.

The smartphone 100 has a housing 101; the housing 101 has clips 104 for receiving an entry pen 124. The entry pen 124 has a pen tip 128 and / or a side switch 126.

The entry pen 124 has internal circuitry for generating a signal when the pen tip 128 is depressed and / or when the side switch 126 is operated when the entry pen 124 is in the proximity of the display 130 of the smartphone 100. The entry pen 124 may or may not have a battery for powering its internal circuitry.

Preferably the entry pen 124 includes internal circuitry for electromagnetic coupling with transmission and sensor coils disposed behind the display 130. Electromagnetic coupling has the advantage that the need for a battery within the entry pen 124 can be avoided as the entry pen is powered by the electromagnetic waves it receives from the transmission coils. For example, the entry pen 124 can be designed in accordance with EP0259894B1 or EP0307667B1.

It is to be noted that there are various design options to removably attach the entry pen 124 to the housing 101 of the smartphone 100. As an alternative to external attachment of the entry pen 124 by means of the clips 104, the housing 101 may have a reception hole for receiving the entry pen 124 with clips disposed inside the reception hole.

The smartphone 100 has an operating system that provides a graphical user interface such as the Symbian OS, the Palm OS or the Pocket PC Operating System.
The graphical user interface has an icon 184 for entering and / or viewing of user settings, an icon 186 for selecting communication functionalities, such as making a phone call, sending an email and / or connecting to the Internet, and icon 188 for access to organiser functionalities, such as entering or viewing a task, a calendar entry, and / or an address, and an icon 190 for access to camera functionalities of the built-in digital camera of the smartphone 100. The graphical user interface of the smartphone 100 may include additional or other icons for access to other functionalities, such as access to the functionalities of a built-in GPS navigation system, a digital photo viewer or the like.

In the preferred embodiment considered here the graphical user interface has a cursor 192; the cursor 192 serves as a pointer for a user’s graphic selection of one of the icons 184 to 190 or of another graphical element of the graphical user interface displayed on the display 130.

The cursor 192 can be moved by means of the entry pen 124 without a need to contact the surface of the display 130. In other words, the user orient the pen tip 128 to a xy position within the display 130 without a requirement to contact the surface of the display 130. The orientation of the pen tip 128 is sensed by means of the receiver coils disposed behind the display 130 and the respective position information is entered into the processor of the smartphone 100. In response, the cursor 192 is moved to the position to which the pen tip 128 points. Hence, a user can conveniently move the cursor 192 to any position within display 130 by means of entry pen 124 without a need to touch the surface of the display 130 with the pen tip 128.

The contactless coupling between the entry pen 124 and the transmission and sensor coils disposed behind the display 130 is schematically illustrated in the perspective view of figure 2.

A printed circuit board 194 is disposed behind the display 130 (cf figure 1) such that it forms an under layer of the display 130. The printed circuit board 194 carries a sensor unit which extends in the plane, including a transmission coil unit for transmission of position detecting signals for detecting the position of the entry pen 124 relative to the display 130. Further, the printed circuit board 194 has a sensor coil unit for receiving position indicating signals indicating the position of the entry pen 124. The sensor coil unit includes a plurality of sensor coils arranged in the x and y directions.
The printed circuit board 194 has a connector 196 for coupling the printed circuit board 194 to an integrated circuit that controls operation of the position sensing and signal exchange with the entry pen 124 and delivers position data and other data such as pen tip up / down information or information indicative of the pen side switch position.

The electromagnetic coupling between the entry pen 124 and the printed circuit board 194 has a certain contactless user range which enables interaction. For example, the electromagnetic coupling between the entry pen 124 and the printed circuit board 194 is sufficiently strong to sense the entry pen position, if the gap 198 between the pen tip 128 and the printed circuit board 194 is below 30mm, preferably below 20mm.

Figure 3 illustrates a user's interaction for selection of a user setting. For entering the user setting the user moves the cursor 192 onto the icon 184 by means of entry pen 124 without a requirement for contacting the surface of the display 130 with the pen tip 128. After the cursor 192 has been moved onto the icon 184 the context menu 197 that is assigned to the icon 184 is displayed on the display 130. The context menu 197 has a number of menu items, e.g. 'lock / unlock phone' for locking / unlocking the smartphone 100, ‘ringing type’ for selection of the ringing tone type, ‘messages’ for reading or deleting a message, ‘auto answer on / off’ for setting the automatic answer functionality on or off, ‘clear last call’ for setting the last-called numbers to be cleared or retained when the smartphone 100 is switched off, ‘emergency’ for setting a key on / off for one-touch dialling of emergency calls, ‘restrictions’ for setting call restrictions and / or other menu items for viewing and / or changing user settings.

In the example considered here the user desires to change the ringing tone type of the smartphone 100.

For setting the ringing tone type the user moves the cursor 192 from the icon 184 over the context menu 197 onto the menu item ‘ringing type’. The menu item ‘ringing type’ has an assigned sub-menu. The fact that the menu item 'ringing type' has a sub-menu is symbolised by the arrow symbol 199 next to the words ‘ringing type’ of the respective menu item. Likewise, the menu items ‘messages’ and ‘restrictions’ have assigned sub-menus as symbolised by the respective arrow symbols. Preferably a selected menu item and/or sub-menu item is highlighted.
When the cursor 192 is on the menu item 'ringing type' the sub-menu 195 that is assigned to the menu item 'ringing type' is displayed next to the arrow symbol 199. In the example considered here, the sub-menu 195 has menu items 'tone A', 'tone B', and 'tone C' corresponding to respective ringing tone types A, B and C.

For example, if the user wants to select the ringing tone type B, he or she moves the cursor 192 onto the menu item 'tone B' over the sub-menu 195 by means of the entry pen 124 without a need to touch the surface of the display 130. When the cursor 192 is on the menu item 'tone B' the user can perform a user input action in order to enter his or her selection of the menu item 'tone B' for entering the selection of the desired ringing tone type B.

This user input action can be performed by depressing the pen tip 128 onto the menu item 'tone B' when the cursor 192 is positioned on the menu item 'tone B'. Alternatively, the user can operate the side switch 126 of the entry pen 124 in order to enter the selection of ringing tone type B when the cursor 192 is positioned on the menu item 'tone B'. In either case the entry pen 124 generates a signal that is received by the senor coils of the printed circuit board 194 (cf. figure 2). That signal is entered into the microprocessor of the smartphone 100 for entry of the user's selection.

If the user selects a menu item within context menu 197 that has no assigned sub-menu the user can select or de-select the respective setting by performing the user input action after the cursor 192 has been moved onto the respective menu item. For example, if the user wants to set automatic answer on or off, he or she moves the cursor 192 onto the 'auto answer on / off' menu item and then performs the user entry action, e.g. depressing the pen tip 128 against the surface of the display 130 or operating the side switch 126.

As icon 184, the other icons 186, 188, and 190 have assigned respective context menus. Access to the context menus, menu items, and sub-menus, if any, works the same way as explained with respect to the icon 184.

The present invention is particularly advantageous as it makes a user's interaction with the smartphone 100 more convenient by enabling contactless selection of context menus, menu items, sub-menus and sub-menu items. In addition to the increased convenience, the contactless selection of menu items has ergonomic advantages. In
particular the invention reduces the risk of repetitive strain injury when the smartphone 100 is used frequently.

Figure 4 shows a block diagram of a more detailed embodiment of a portable hand-held electronic appliance 300. For example, the electronic appliance 300 is an implementation of the smartphone 100 (cf. figures 1, 2 and 3). Elements of the electronic appliance 300 that correspond to elements of the smartphone 100 are designated by like reference numerals.

The electronic appliance 300 has a position sensor 302 for sensing the position of an entry pen 324. The position sensor 302 can be implemented as a printed circuit board (cf. printed circuit board 194 shown in figure 2). The position sensor 302 is located behind the display 330 for sensing a position of the entry pen 324 relative to the display and for receiving user entry signals from the entry pen 324. The entry pen 324 has a side switch 326 that can be operated by a user and a pen tip 328. The display 330 can be a liquid crystal display or an organic light emitting diode (OLED) display or another kind of display.

The position sensor senses the position of the entry pen 324 relative to the display 330 by electromagnetic coupling. In addition to the position detection, the position sensor 302 can receive a user entry signal from the entry pen 324. A user entry signal is an electromagnetic signal that is emitted from the entry pen 324 in order to indicate a switch position of the side switch 326 and/or whether the pen tip 328 is depressed or not.

The electronic appliance 300 has an integrated circuit 306 for controlling operation of the position sensor 302 and for processing position signals received from the position sensor 302. The integrated circuit 306 has analogue circuitry 332 that comprises a transmission component 334 and a reception component 336. The transmission component 334 and the reception component 336 serve to generate control signals 338 for controlling the transmission of electromagnetic signals from the position sensor 302 to the entry pen 324 and the reception of electromagnetic signals from the entry pen 324 by the position sensor 302. The resultant position signal 304 that carries the position information is received by the reception component 336 which provides the sampled position signal 304 to the position signal processing component 310.
The position signal processing component 310 belongs to logic circuitry 340 of the integrated circuit 306. In the preferred embodiment considered here, the position signal processing component 310 is provided by a set of instructions of the firmware 342 which is executed by logic circuitry 340.

In addition, the firmware 342 has a position sensor control component 344 which is a set of firmware instructions for controlling overall operation of the position sensor 302 and the analogue circuitry 332. Further, the firmware 342 has a generator component 346 which is a set of firmware instructions for generating an identifier for each position dataset that is provided by the position signal processing component 310. The interrupt component 348 is a set of firmware instructions for generating an interrupt 320 when a new acquisition scan of the position data is performed.

Further, the integrated circuit 306 has a memory 314. The memory 314 has a predefined memory location 350 for storing the identifier of a position dataset. The memory 314 has predefined memory locations 352, 354, 356, 358 and 360. These memory locations 352 to 360 serve for storage of a complete position dataset.

A complete position data set can consist of a sensed x-position and y-position of the entry pen 324, pressure data indicative of the pressure with which the pen tip 328 of the entry pen 324 is depressed against the display 330, a pen tip up / down bit indicating whether the pen tip 328 is depressed against the display 330 or not, and pen side switch information indicating the position of the side switch 326 of the entry pen 324.

The memory location 352 is permanently assigned to the x-position, the memory location 354 is assigned to the y-position, the memory location 356 is assigned to the pressure data, the memory location 358 is assigned to the pen tip up / down bit and the memory location 360 is assigned to the pen side switch information. In other words, the memory 314 has a memory mapped area where each component of a position data set and the identifier of the position data set is always stored on a pre-defined memory location.

The integrated circuit 306 is coupled to an integrated circuit 308 of the electronic appliance 300. The integrated circuit 306 has a bus interface 362 for sending a position dataset 312 and its identifier to the integrated circuit 308. The integrated circuit 308 has a bus interface 364. For example, the bus interfaces 362 and 364 connect the integrated
circuits 306 and 308 by means of a data bus such as the SPI, IIC and / or UART data buses.

The integrated circuit 308 has logic circuitry 366 for execution of various program components. For example, the logic circuitry 366 can serve for execution of a program component 368 for providing a telecommunication functionality such as a mobile telephony, email and / or Internet functionality, a program component 370 for providing an electronic organiser functionality, a program component 372 for providing a navigation system, and a program component 374 for providing a digital camera functionality. Further, the logic circuitry 366 serves for execution of a program component 376 that provides an operating system and program component 377 that provides a graphical user interface. The program component 377 may or may not be an integral part of the program component 376.

The integrated circuit 308 has a memory 316 for storing the position dataset 312.

The portable electronic device 300 has a battery 378 for providing power to the various components of the portable electronic device, including the integrated circuit 308. The display 330 is coupled to the integrated circuit 308 for displaying the elements of the graphical user interface provided by the program component 377 and for displaying various information and user data related to one or more of the functionalities provided by the program components 368, 370, 372 and 374. The elements of the graphical user interface include icons to which context menus are assigned (cf. icons 184, 186, 188, 190 of figure 1). Preferably, each context menu has menu items of the same category.

The electronic appliance 300 can have an integrated antenna 380 for providing a wireless interface to a digital telecommunication network. Likewise, the antenna 380 can be required for providing a navigation functionality such as for reception of global positioning system (GPS) signals.

In operation a user of the electronic appliance 300 can select a menu item by orienting the entry pen 324 towards the menu item. For example, this can be done by moving a cursor provided by the graphical user interface onto the menu item without a need for contacting the surface of the display with the entry pen 324 (cf. figure 3). For entering the user's selection of the menu item the user can operate the side switch 326 and / or press the
pen tip 328 against the surface of the display 330. In response, the entry pen 328 sends
and electromagnetic signal that is sensed by the sensor coils of the position sensor 302,
and/or the side switch signal.

The analogue circuitry 332 is controlled by the position sensor control component 344 to
provide control signals 338 to the position sensor 302 for acquisition of a position signal
304. The position signal 304 is analogue to digital converted and provided to the position
signal processing component 310 in order to extract the position dataset 312 from the
digitised position signal 304.

The generator component 346 provides an identifier for the new position dataset 312. In
the preferred embodiment considered here, the generator component 346 is implemented
as a scan counter which counts the data acquisitions of position datasets 312 performed
by the position sensor control component 344. With each position data acquisition scan
that is performed by the position sensor 302 under the control of the position sensor
control component 344 the scan counter is incremented or decremented depending on
the implementation.

The position signal processing component 310 writes the position dataset 312 and the
scan number provided by the generator component 346 to the memory mapped area of
the memory 314. In other words, the scan number is written to the memory location 350,
the x-position data to the memory location 352, the y-position data to the memory location
354, the pressure information to the memory location 356, the pen tip up / down bit to the
memory location 358 and the pen side switch information to the memory location 360.

When the scan number and the new position dataset 312 are written to the memory 314
the interrupt component 348 is invoked in order to generate and interrupt 320 which is
sent from the integrated circuit 308 to the integrated circuit 308.

The interrupt 320 is received by the integrated circuit 308. In response a read operation
of the memory mapped area of the memory 314 is performed by the integrated circuit 308
by means of its bus interface 364. For example, the integrated circuit 308 reads the
memory mapped area from the memory location 350 to the memory location 360 in
sequential order. After these read operations the integrated circuit 308 performs another
read operation in order to read the memory location 350 again. If the content of the
memory location 350 is the same for both the initial read operation and the read operation after having read the dataset 312, this indicates that the dataset 312 is valid. If the contrary is the case, this indicates that the position signal processing component 310 has performed another write operation of a new position data set while the integrated circuit 308 has attempted to read the previous position dataset 312. In the latter case the integrated circuit 308 re-attempts to read the content of the memory mapped area of the memory 314 for reading a consecutive up-to-date position dataset 312.

The position dataset 312 is stored in the memory 316 of the integrated circuit 308 for access by the program components 368, 370, 372 and / or 374.

Figure 5 shows a corresponding diagram illustrating the operation of the electronic appliance of figure 4. As shown in figure 5 the operation of the position detection circuitry provided by the position sensor 302/integrated circuit 306 and operation of the host processor provided by the integrated circuit 308 can be independent and asynchronous.

The process 400 performed by the position detection circuitry comprises the following steps:

In step 402 a position scan is performed for acquisition of a position dataset that includes at least x, y position data of the current position of the entry pen with respect to the display in the x, y plane. In step 404 the scan counter is incremented or decremented. The position signal acquired from the position scan performed in step 402 is processed in step 406 which provides the position dataset. The position dataset and the scan counter value are stored in a memory mapped storage region (step 408). Further, an interrupt is sent to the host processor in step 410 in order to signal the availability of up-to-date position data in the memory mapped storage region. From step 410 the control goes back to step 402 for performance of a consecutive position data acquisition.

The process 412 performed by the host processor comprises the following steps:

In step 414 the host processor receives an interrupt from the position detection circuitry (cf. step 410). In response the host processor reads the scan counter value from the memory mapped storage region (416). Next, the host processor reads the position dataset from the memory mapped storage region (step 418). In step 420 the host processor re-reads the scan counter value from the memory mapped storage region.
If the scan counter values that have been read in the steps 416 and 420 are identical, this implies that the position dataset that has been read in step 418 is valid (step 422) and the position dataset is provided to an application for further processing (step 424). If the contrary is the case, this implies that the position dataset was in the process of being overwritten with a new position dataset during the read operation performed in step 418.

As a consequence, the control goes back from step 422 to step 416 in order to perform a new read attempt of valid position data from the memory mapped storage region.

The position data indicates a current position of the entry pen with respect to the display of the hand-held electronic appliance. If the graphical user interface provides a cursor icon on the display, the desired position of the cursor icon is given by the position data acquired from the position sensor. In other words, the cursor icon follows the entry pen’s movement when the entry pen hovers above the surface of the display.

Figure 6 shows an exemplary configuration of the position detecting circuitry that can be used for acquisition of the position data. Elements in the embodiment of figure 6, that correspond to elements in the embodiments of figure 1 to 4 are designated by like reference numerals.

The position detecting system according to the preferred embodiment considered here includes a position indicator 524 for indicating a position and a position detecting apparatus 502 for detecting the position of the position indicator 524.

The position indicator 524 includes at least one coil and indicates a position. For example, the position indicator 524 includes a coil and a capacitor connected to the coil, in which the capacitor and the coil form a resonant circuit. Preferably, the position indicator 524 includes additional circuitry for generating an electromagnetic signal when the user performs a user input action, such as operating the switch of the position indicator 524.

The position detecting apparatus 502 includes a control unit 544, a transmission control unit 534 for generating position detecting signals, a transmission circuit 535, a sensor unit 503 serving as a sensor area, a switching unit 507 for selecting / switching sensor coils, a reception circuit 536 and a coordinate detection unit 510.
The sensor unit 503, which extends in the plane, includes a transmission coil unit 580 for transmitting position detecting signals for detecting the position of the position indicator 524; and a sensor coil unit 582 for receiving position indicating signals indicating the position of the position indicator 524. The sensor coil unit 582 includes a plurality of sensor coils arranged in the x-direction (x-direction sensor coils) and a plurality of sensor coils arranged in the y-direction orthogonal to the x-direction (y-direction sensor coils).

The control unit 544 corresponds to the signal transmitting unit, the receiving unit and the position detecting unit; the transmission control unit 534 and the transmission circuit 535 correspond to the signal transmitting unit; the switching unit 507 and the reception circuit 536 correspond to the receiving unit; and the coordinator detection unit 510 corresponds to the position detection unit.

The control unit 544 controls the position detecting apparatus 502 and also controls the transmission control unit 534, the switching unit 507, the reception circuit 536 and the coordinator detection unit 510.

The transmission control unit 534 generates position detecting signals for detecting a position indicated by the position indicator 524 under the control of the control unit 544. The transmission circuit 535 amplifies the position detecting signals from the transmission control unit 534 and supplies the position detecting signals to the transmission coil unit 580, which is provided in the sensor unit 503. Accordingly, the transmission coil unit is driven. The sensor coils are scanned using the switching unit 507 and the reception unit 536 for position detection by coordinate detection unit 510.

In addition the sensor coils can serve for reception of the electromagnetic signal that is emitted by the position indicator 524 when the user performs the user input action, such as operating a switch of the position indicator 524 (cf. side switch 126, 326 or pen tip 128, 328 cf. Fig. 1, 2, 3, and 4 respectively). The respective user entry signal is provided as part of the position dataset to the host processor (cf. pentip up/down bit or pen side switch information within dataset 312). In response, the graphical user interface signals entry of the graphically selected menu item which causes a respective entry of a user setting or invokes a certain functionality.
The various components that are required for controlling a driving operation of the position sensor 502 are provided by a mixed analogue/digital application specific integrated circuit 506 which has a similar design as the integrated circuit 306 of figure 4. The components of the integrated circuit 506 related to the storage of position data and interfacing with a host processor are not shown in figure 6 for ease of explanation.

Figure 7 illustrates an embodiment of the method of the invention. In step 700 a number of icons are displayed on the display of a hand-held electronic appliance, such as a smartphone, a PDA, a navigation system, an electronic organiser, a digital camera or another multifunctional hand-held electronic appliance. Preferably each icon has an assigned context menu that comprises a number of menu items of the same category.

In step 702 the user moves an entry pen over one of the icons with or without contacting the display surface. When the xy position of the entry pen equals the xy position of one of the icons the context menu assigned to that selected icon is displayed (step 704). Depending on the implementation, close proximity of the entry pen to the xy position of the icon is sufficient to trigger display of the respective context menu. One of the menu items of the context menu can be selected by the user by moving the entry pen to the xy position of the desired menu item (step 706). Again, this can be performed with or without contacting the display surface.

In step 708 it is determined whether the selected menu item has an assigned sub-menu. If this is the case the sub-menu is displayed in step 710 and the user can select one of the menu items of the sub-menu by orienting the entry pen towards the xy position of the desired menu item of the sub-menu with or without contacting the display with the entry pen (step 712). From there the control goes back to step 708.

If it is determined in steps 708 that a selected menu item does not have an assigned sub-menu the control goes to step 714. In step 714 the user can enter his or her selection of a menu item by performing a user input action. For example, the user depresses the entry pen against the display surface for entering the selection of the menu item that has not an assigned sub-menu. Alternatively the user operates a switch of the entry pen for entry of the selection.
<table>
<thead>
<tr>
<th>Reference Numeral</th>
<th>Description</th>
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<tbody>
<tr>
<td>100</td>
<td>Smartphone</td>
</tr>
<tr>
<td>101</td>
<td>Housing</td>
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<tr>
<td>102</td>
<td>Position Sensor</td>
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<td>Clips</td>
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<td>Connector</td>
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197  Context Menu
198  Gap
199  Arrow Symbol
300  Electronic Appliance
302  Position Sensor
304  Position Signal
306  Integrated Circuit
308  Integrated Circuit
310  Position Signal Processing Component
312  Position Dataset
314  Memory
316  Memory
320  Interrupt
324  Entry Pen
332  Analogue Circuitry
334  Transmission Component
336  Reception Component
338  Control Signal
340  Logic Circuitry
342  Firmware
344  Position Sensor Control Component
346  Generator Component
348  Interrupt Component
350  Memory Location
352  Memory Location
354  Memory Location
356  Memory Location
358  Memory Location
360  Memory Location
362  Bus Interface
364  Bus Interface
366  Logic Circuitry
368  Program Component
370  Program Component
372  Program Component
374  Program Component
376  Program Component
377  Program Component
378  Battery
380  Antenna
502  Position Detecting Apparatus
503  Sensor Unit
506  Integrated Circuit
507  Switching Unit
510  Coordinate Detection Unit
524  Position Indicator
534  Transmission Control Unit
535  Transmission Circuit
536  Reception Circuit
544  Control Unit
580  Transmission Coil Unit
582  Sensor Coil Unit
1. A hand-held electronic appliance comprising:
   - graphical user interface means (130; 330, 377) for displaying at least one context menu (195, 197) the context menu having a number of menu items,
   - pen entry means (124, 194; 302, 306, 324; 502, 524) for contactless selection of one of the menu items,
   - means (126, 128; 326, 328) for entering the selection.

2. The hand-held electronic appliance of claim 1, at least one menu item having an assigned context sub-menu (195), the graphical user interface means being adapted to display the sub-menu in response to the contactless selection of the at least one menu item.

3. The hand-held electronic appliance of claim 1 or 2, the graphical user interface means comprising at least one icon (184, 186, 188, 190) being representative of a respective context menu, the pen entry means being adapted for contactless selection of the at least one icon and the graphical user interface means being adapted to display the context menu in response to the contactless selection of the at least one icon.

4. The hand-held electronic appliance of claim 3, the graphical user interface means comprising a plurality of context menus being represented by respective icons (184, 186, 188, 190), each context menu comprising menu items belonging to a common category.

5. The hand-held electronic appliance of claim 4, one of the icons of the graphical interface means being representative of the category user settings.

6. The hand-held electronic appliance of claim 4 or 5, one icon of the graphical user interface means being representative of the category communication functions.
7. The hand-held electronic appliance of claim 4, 5, or 6, one icon of the graphical user interface means being representative of the category organiser functions.

8. The hand-held electronic appliance of any one of claim 4 to 7, one icon of the graphical user interface means being representative of the category digital camera functions.

9. The hand-held electronic appliance of any one of claim 4 to 8, one icon of the graphical user interface means being representative of navigation functions.

10. The hand-held electronic appliance of any one of the preceding claims, the graphical user interface means being adapted to highlight a selected menu item.

11. The hand-held electronic appliance of any one of the preceding claims, the graphical user interface means comprising a display (130; 330) and the pen entry means comprising a position sensor (302; 502) for sensing the position of an entry pen (124; 324; 524) relative to the display while the entry pen is in proximity to the display.

12. The hand-held electronic appliance of any one of the preceding claims, the pen entry means comprising a capacitive proximity sensor.

13. The hand-held electronic appliance of any one of the preceding claims, the pen entry means being adapted to sense a position of an entry pen by electromagnetic coupling.

14. The hand-held electronic appliance of any one of the preceding claims, the pen entry means having an entry pen, the entry pen comprising a user operable input element (126, 128; 326, 328) for entering the selection.

15. The hand-held electronic appliance of claim 14, the user operable input element being a pen tip (128; 328) of the entry pen, the entry pen being adapted to send a pen tip down signal when the pen tip is depressed against the surface of the display.
16. The hand-held electronic appliance of claim 14 or 15, the user operable input element being a switch (126; 326), the entry pen being adapted to send an entry signal in response to operation of the switch in order to signal entry of the selection.

17. The hand-held electronic appliance of any one of the preceding claims being or comprising a mobile phone, a smartphone, a personal digital assistant, a navigation system, a digital camera, and / or a digital photo viewer.

18. A method of entering a selection of a menu item of a context menu into a hand-held electronic appliance comprising:

- displaying the context menu (195, 197), the context menu having a number of menu items,

- contactless selection of one of the menu items by means of an entry pen (124; 324; 524),

- entering the selection by performing a single user entry action (126, 128; 326, 328).

19. The method of claim 18, the single user entry action consisting of depressing the entry pen against a display of the hand-held electronic appliance.

20. The method of claim 18 or 19, the single user entry action consisting of operating a switch of the entry pen.

21. The method of claim 18, 19 or 20, wherein at least one menu item has an assigned context sub-menu (195), and further comprising displaying the sub-menu in response to the contactless selection of the one menu item.
FIG. 5

Position Detection Circuitry

Position Scan

Scan Counter Incrementation

Position Signal Processing

Position Data + Scan Counter Value to Memory

Interrupt to Host

Host

Interrupt

Read Scan Counter Value from Memory

Read Position Data from Memory

Re-Read Scan Counter Value from Memory

Scan Counter Value unchanged? yes

Position Data to Application

no
FIG. 6
Display icons

Move entry pen over one of the icons without contacting display surface

Display context menu assigned to selected icon

Move entry pen over one of the context menu items without contacting display surface

Does selected item have assigned sub-menu?

Yes → Display sub-menu

Move entry pen over one of the sub-menu items without contacting display surface

Enter selection of menu or sub-menu item by depressing entry pen against display surface

FIG. 7
A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F3/033

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of box C.

Date of the actual completion of the international search:

29 March 2005

Date of mailing of the international search report:

05/04/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel: (31-70) 340-2040, Tx: 31 651 epo nl, Fax: (31-70) 340-3016

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Kirsten, K
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