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(54) **Mobile station having improved user interface providing application management and other functions**

(57) A method is disclosed for operating a mobile station (10), comprising steps of (a) providing the mobile station to have a user interface (11) comprised of a display (20) and at least one user input device (22, 23); (b) displaying to the user an identification of a plurality of Applications that the mobile station is capable of executing, the identifications being simultaneously displayed in a grid or list format; (c) manipulating the input device to select one of the displayed Application indica-

tions; and, in response to further input from the user, (d) displaying a list of Options that are available for the selected Application. This invention provides a novel user interface for a mobile station, wherein a user is given control over the Applications of the mobile station in a readily comprehended visual manner, and wherein data of various types is treated simply as an object that can be freely moved between and/or shared by Applications, with data format conversions being made as required (e.g., character string to numeric string).

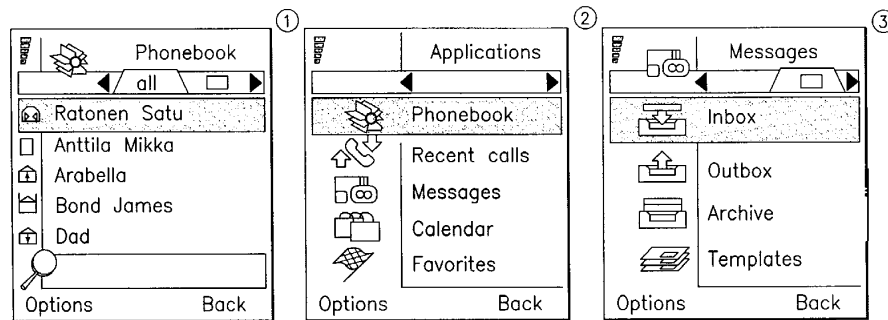


FIG.5

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Description**FIELD OF THE INVENTION:**

5 [0001] This invention relates generally to mobile stations, such as cellular radio telephones and personal communicators, and more particularly relates to user interfaces for mobile stations.

BACKGROUND OF THE INVENTION:

10 [0002] Modern radio telephones, referred to herein generally as mobile stations, typically have a display, a keypad and associated software drivers for providing a user interface. With the aid of the user interface a user of the mobile station is enabled to place telephone calls and program various features of the mobile station. For those mobile stations that operate with a digital wireless network the user may also have the ability to receive text messages, compose and transmit text messages, receive and transmit e-mail, forward calls, access voice mail, as well as take advantage of a
15 number of other valuable communication features.

[0003] It can thus be appreciated that the user interface is a key component of the mobile station, and that the flexibility, ease of use, and functionality of the user interface are important features that relate to the overall operation of the mobile station. In that the quality of the user interface is directly perceived and experienced by the user of the mobile station, the user interface is an important feature of the overall mobile station design and implementation.
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OBJECTS AND ADVANTAGES OF THE INVENTION:

[0004] It is a first object and advantage of this invention to provide an improved user interface for a mobile station.

25 [0005] It is a further object and advantage of this invention to provide an improved user interface for a mobile station that enables one hand operation of a manipulator to gain access to and interact with all applications.

[0006] It is a further object and advantage of this invention to provide a multimedia user interface for a mobile station that enables input data from different sources, such as text input, recorded voice input, and image input, to be combined together into a unified whole for presentation to an operator.

30 [0007] It is a further object and advantage of this invention to display user-selectable options using a "pop-up" menu technique wherein available options may be partitioned into different logical groups of options.

[0008] It is a further object and advantage of this invention to provide a user of a mobile station with an ability to "bookmark" certain objects, such as selectable strings and application icons, and to enable the bookmarked objects to form a separate view of user-preferred objects.

35 [0009] It is another object and advantage of this invention to provide a mobile station object handling method wherein there is displayed a menu of functions operable in the context of a currently displayed object, and enabling the user to activate a selected function, such as by editing, erasing, copying, moving, and making a query.

SUMMARY OF THE INVENTION

40 [0010] The foregoing objects and advantages are realized by methods and apparatus in accordance with embodiments of this invention.

[0011] A method is disclosed for operating a mobile station, comprising steps of (a) providing the mobile station to have a user interface comprised of a display and at least one user input device; (b) displaying to the user an identification of a plurality of Applications that the mobile station is capable of executing, the identifications being simultaneously displayed in a grid or list format; (c) manipulating the input device to select one of the displayed Application indications; and, in response to further input from the user, (d) displaying a list of Options that are available for the selected Application. The step of displaying the available Applications can include a step of grouping the displayed identifications into user-specified Application groups.
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[0012] The Options are preferably displayed in a pop-up menu format that is displayed over the currently displayed Application screen. At least some of the displayed Options are logically grouped together in Option categories, the categories being comprised of context specific Options, state specific Options, Application specific options, and general Options.
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[0013] The mobile station stores data related to a first Application, and the method further includes steps of (e) manipulating the input device to designate all or a portion of the stored data; and (f) further manipulating the input device to associate the designated data with at least one other, different Application, or with a different location in the same Application. The stored data could be image data, recorded voice data, textual data, or any data that can be suitably stored within a memory that is locally or remotely accessible by the mobile station. In one embodiment the stored data is comprised of a message that was received from a wireless network, such as a Short Message Service
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(SMS) or E-mail message, wherein the designated data is comprised of a character string that represents a telephone number, and wherein the at least one other different Application is an Application that uses a numeric telephone number. By example, the different Application could be an Application that originates a call to the telephone number, or it may be a speed dial or a call barring Application. In another embodiment the user is enabled to Bookmark certain data and store an identifier for the Bookmarked data in a separate Application. Subsequently selecting the separate Application, and then selecting one of the identifiers, results in the associated data being recalled from memory and displayed to the user.

[0014] In general, this invention provides a novel user interface for a mobile station, wherein a user is given control over the Applications of the mobile station in a readily comprehended visual manner, and wherein data of various types is treated simply as an object that can be freely moved between and/or shared by Applications, with data format conversions being made as required (e.g., character string to numeric string).

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The above set forth and other features of the invention are made more apparent in the ensuing Detailed Description of the Invention when read in conjunction with the attached Drawings, wherein:

Fig. 1 is a block diagram of a mobile station that is constructed and operated in accordance with this invention;

Fig. 2 is an elevational view of the mobile station shown in Fig. 1, and which further illustrates a cellular communication system to which the mobile station is bidirectionally coupled through wireless RF links;

Fig. 3A illustrates a display screen format for Applications arranged in a grid format;

Fig. 3B illustrates a display screen format for Applications arranged in a list format;

Figs. 3C and 3D are examples of displayed check boxes and radio buttons, respectively;

Fig. 3E is an example of a displayed slider;

Fig. 4 depicts several display screens and shows a logical progression of screens in response to input from a user, the Figure being particularly useful in explaining the Application management of the mobile station of Figs. 1 and 2;

Fig. 5 depicts several display screens and shows examples of selection lists;

Fig. 6 depicts two display screens and shows an example of a multi-selection list;

Fig. 7 depicts several display screens and shows examples of selection grids;

Fig. 8 depicts several display screens and shows examples of zooming and scrolling data;

Fig. 9 depicts two display screens and shows an example of context sensitive Options;

Fig. 10 depicts several display screens and shows a logical progression of screens in response to input from a user, the Figure being particularly useful in explaining the editing of data in a field;

Fig. 11 is an example of a pop-up menu;

Fig. 12 depicts two display screens and shows a logical progression of screens in response to input from a user, the Figure being particularly useful in explaining the addition of a Bookmark to a Favorites list;

Fig. 13 depicts two display screens and shows a logical progression of screens in response to input from a user, the Figure being particularly useful in explaining the recalling of a Bookmark from the Favorites list;

Fig. 14 is a further example of a pop-up menu;

Fig. 15 is a high level diagram of an Intelligent Service Architecture within which this invention resides;

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Fig. 16 is a high level diagram of a mobile station hardware/software architecture in accordance with an aspect of this invention;

Fig. 17 depicts a relationship between a Personal Number Directory (PND) server and various database entries;

Fig. 18 depicts a relationship between an Imaging server and various database entries; and

Fig. 19 depicts a relationship between a Voice Recorder server and various database entries.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Reference is made to Figs. 1 and 2 for illustrating a wireless user terminal or mobile station 10, such as but not limited to a cellular radiotelephone or a personal communicator, that is suitable for practicing this invention. The mobile station 10 includes an antenna 12 for transmitting signals to and for receiving signals from a base site or base station 30. The base station 30 is a part of a cellular network comprising a Base Station/Mobile Switching Center/Interworking function (BMI) 32 that includes a mobile switching center (MSC) 34. The MSC 34 provides a connection to landline trunks when the mobile station 10 is involved in a call.

[0017] The mobile station includes a modulator (MOD) 14A, a transmitter 14, a receiver 16, a demodulator (DEMOD) 16A, and a controller 18 that provides signals to and receives signals from the transmitter 14 and receiver 16, respectively. These signals include signalling information in accordance with the air interface standard of the applicable cellular system, and also user speech and/or user generated data. The air interface standard may have any form, such as one based on time division multiple access (TDMA) or code division multiple access (CDMA), as the teachings of this invention are not constrained for use with any one particular air interface.

[0018] It should thus be understood that the mobile station 10 can be a vehicle mounted or a handheld device, and that the mobile station 10 can be capable of operating with one or more air interface standards, modulation types, and access types.

[0019] It is understood that the controller 18 also includes the circuitry required for implementing the audio and logic functions of the mobile station. By example, the controller 18 may be comprised of a digital signal processor device, a microprocessor device, and various analog to digital converters, digital to analog converters, and other support circuits. The control and signal processing functions of the mobile station are allocated between these devices according to their respective capabilities.

[0020] A user interface 11 includes a conventional earphone or speaker 17, a conventional microphone 19, a point addressable display 20 (preferably enabling the display of icons and images, as well as text), and a user input device, typically a keypad 22, all of which are coupled to the controller 18. The keypad 22 includes the conventional numeric (0-9) and related keys (#,*) 22a, and other keys 22b used for operating the mobile station 10. These other keys 22b may include, by example, a SEND key, various menu scrolling and soft keys, and a PWR key.

[0021] The user interface 11 further comprises, in a preferred embodiment of this invention, an integrated pointing or display navigation device 23. The navigation device 23 is capable of at least two degrees of motion, such as motion within an x-y coordinate system related to a display screen 20 x-y coordinate system. The controller 18 receives inputs from the navigation device 23 and converts same into cursor 20a positions on the display screen 20, and/or to selectively highlight a specified line or region. By example, the navigation device 23 may function in a manner similar to a joystick, rollerball, or a mouse. The navigation device 23 further includes at least one switch 23a whereby, for example, depressing the manually operated portion causes a switch closure that is detectable by the controller 18 as a user acknowledgement or "OK". For example, by employing the navigation device 23 the user is enabled to designate a desired x-y location on the display screen 20, and then cause a closure of the switch 23a which is interpreted by the controller 18 as a command to take some type of action related to the designated screen location. The use of the navigation device 23 is further detailed below in the description of presently preferred embodiments of user interface methods.

[0022] The navigation device 23 could be implemented using four scroll-keys with a separate OK-key located in the middle of the four keys, or by using a 4-directional joystick with select (OK) functionality when depressed. In another embodiment the navigation device 23 is implemented with two right/left keys placed adjacent to a single axis (up-down) roller portion. It should thus be appreciated that the navigation device 23 could be implemented in a variety of different suitable embodiments.

[0023] It is noted that in a preferred embodiment the navigation device 23 is capable of being operated by the user with only one hand, thereby simplifying the user's interaction with the novel multimedia user interface 11 of this invention.

[0024] The mobile station 10 also includes a battery 26 for powering the various circuits that are required to operate the mobile station.

[0025] The mobile station 10 also includes various memories, shown collectively as the memory 24, wherein are stored a plurality of constants and variables that are used by the controller 18 during the operation of the mobile station.

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For example, the memory 24 stores the values of various cellular system parameters and the number assignment module (NAM). An operating program for controlling the operation of controller 18 is also stored in the memory 24 (typically in a ROM device). The memory 24 may also store data, including user messages, that are received from the BMI 32 prior to the display of the messages to the user. Various display screen presentations, text, and images are also stored in the memory 24, as will be discussed below.

[0026] The operating program in the memory 24 includes routines to present messages and message-related functions to the user on the display 20, typically as various menu items. The memory 24 also includes routines for implementing the methods described below.

[0027] By way of introduction, the user interface 11 in accordance with the teaching of this invention allows features and keys to be added and removed easily without having to change the basic architecture or design of the mobile station 10. Preferably, the user interface 11 is such that the user can operate the mobile station 10 using one hand, including accessories.

[0028] The user interface 11 generally supports two methods of operation: a fast method for advanced users (using shortcuts, etc.) and an step-by-step simplified method for new users.

[0029] When the user presses a key in the idle mode, the display 20 responds in a way that informs the user of the key's primary function, which could be a shortcut.

[0030] During the operation of the user interface 11 the phone function is always available. A primary application is one referred to as Phonebook, and the basic state of the phone is Phone Idle.

[0031] The user interface 11 embodies an application centricity approach, wherein multitasking possibilities exist, and wherein a dedicated Application-key ensures all applications are available at all times, and furthermore enables the user to easily swap between different functions/applications. Each application has a clearly recognizable application idle state. A separate clear-key is preferably placed together with the numeric keys.

[0032] The user interface 11 also embodies an intuitive navigation and selection approach, wherein the manually operated navigation device 23 is employed as primary control device. The press capability of the navigation device 23 is used to Select/Zoom consistently through the user interface 11.

[0033] Further in accordance with this invention, all available functions/commands in any state can be found in an options list (accessed via a Left-softkey designated as Options). The options list displays as a pull-down menu, which visually has a close relation to the displayed functions/commands.

[0034] The keypad 22 preferably contains at least the following keys: two softkeys (Left and Right), the navigation device 23 (e.g., roller + ScrollLeft + ScrollRight with press capability=OK), the Application-key, the Send-key, the End-key, the Clear-key, and an ITU-T compatible alpha/numeric keypad.

[0035] The Left soft-key is generally used for options; both general options (options applying to a certain situation, e.g. application options and settings) and to context-sensitive options, such as those options that apply to a currently selected item (e.g. delete a highlighted message).

[0036] The Right soft-key is generally used for cancel, backstep, or quit operations. In the application Idle state the Right soft key is generally used for backstepping.

[0037] In Edit situations, scrolling the navigation device 23 up/down is used for moving the cursor 20a up and down one line. The Right/Left soft-keys are used in Edit situations to move the cursor 23a right and left.

[0038] In situations where data are being viewed in a Details mode, e.g. memory entries, the Right/Left soft-keys are used to move the view to respectively the next and the previous item. In a Calendar View situation, the Right/Left soft-keys are similarly used to move to the next/previous day, week, month or day; depending on what is currently being viewed. By pressing the navigation device 23 the user selects the highlighted item.

[0039] In situations where a highlighted entry is a specific text string or a number, pressing the navigation device 23 causes the controller 18 to enter a combined Edit/View mode where the user can see the text/number in its entirety and then edit the text/number, or it may cause context-sensitive options to be presented to the user.

[0040] Pressing the Application-key displays an Application Selection List, allowing the user to switch to another application. This can also be done during a call. Double pressing the Application key provides a short cut to the Idle state. A long press of the Application key gives n (e.g., 3) of the last used applications.

[0041] The Send-key is used to create a call, i.e. if the current display contains a phone number, pressing the Send-key initiates a call to the number. In the Phone Idle state the Send-key is used instead to display the Call Registers (the last-dial list as a default list) . In any other application the Send-key is used to access the Phone Idle state.

[0042] The following table defines the functionality of Send-key in different states of the mobile station 10:

Number of active calls:			
Phone's state:	0	1	2
Phone Idle	redial	hold/unhold	swap

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