Exhibit “A”

US006976217B1

(12) **United States Patent**
Vertaschitsch et al.

(10) **Patent No.: US 6,976,217 B1**
(45) **Date of Patent: Dec. 13, 2005**

(54) **METHOD AND APPARATUS FOR INTEGRATING PHONE AND PDA USER INTERFACE ON A SINGLE PROCESSOR**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 538 days.

(21) Appl. No.: **09/687,987**

(22) Filed: **Oct. 13, 2000**

(51) **Int. Cl.**[7] **G06F 3/00**; H04M 11/00

(52) **U.S. Cl.** **715/717**; 715/864; 715/771; 379/90.01; 379/93.19; 379/93.23; 379/110.01; 455/556; 455/575

(58) **Field of Search** 345/864, 771, 345/776, 716–718, 863, 963, 727, 978, 839; 379/90.01, 93.09, 93.05, 93.17, 93.19, 93.23, 110.01, 419, 441, 442, 456; 455/74, 556, 557, 566, 565

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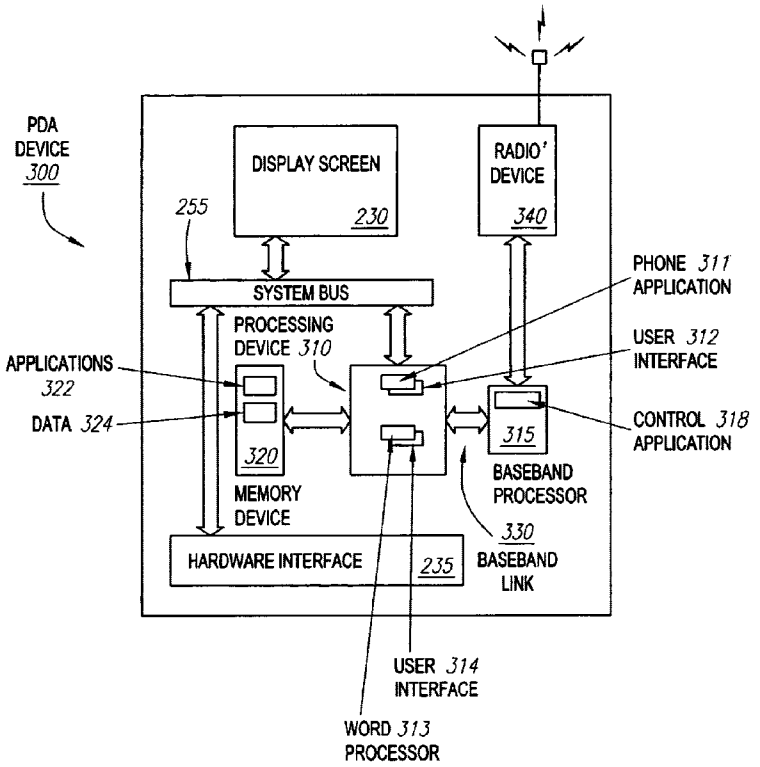
(57) **ABSTRACT**

Separate processors, a PDA processor, and a baseband processor are maintained in a PDA having an integrated telephone device. The PDA processor runs PDA related programs and a user interface for the telephone device. A link between the PDA processor and baseband processor transfers data and commands from the user interface to a phone control program executing on the baseband processor. The base band processor is connected to the telephone device, and the phone control program controls operation of the telephone device. The separation of processors reduces vulnerability of the telephone device to hacker rogue applications that invade or program crashes that occur on the PDA processor.

21 Claims, 8 Drawing Sheets



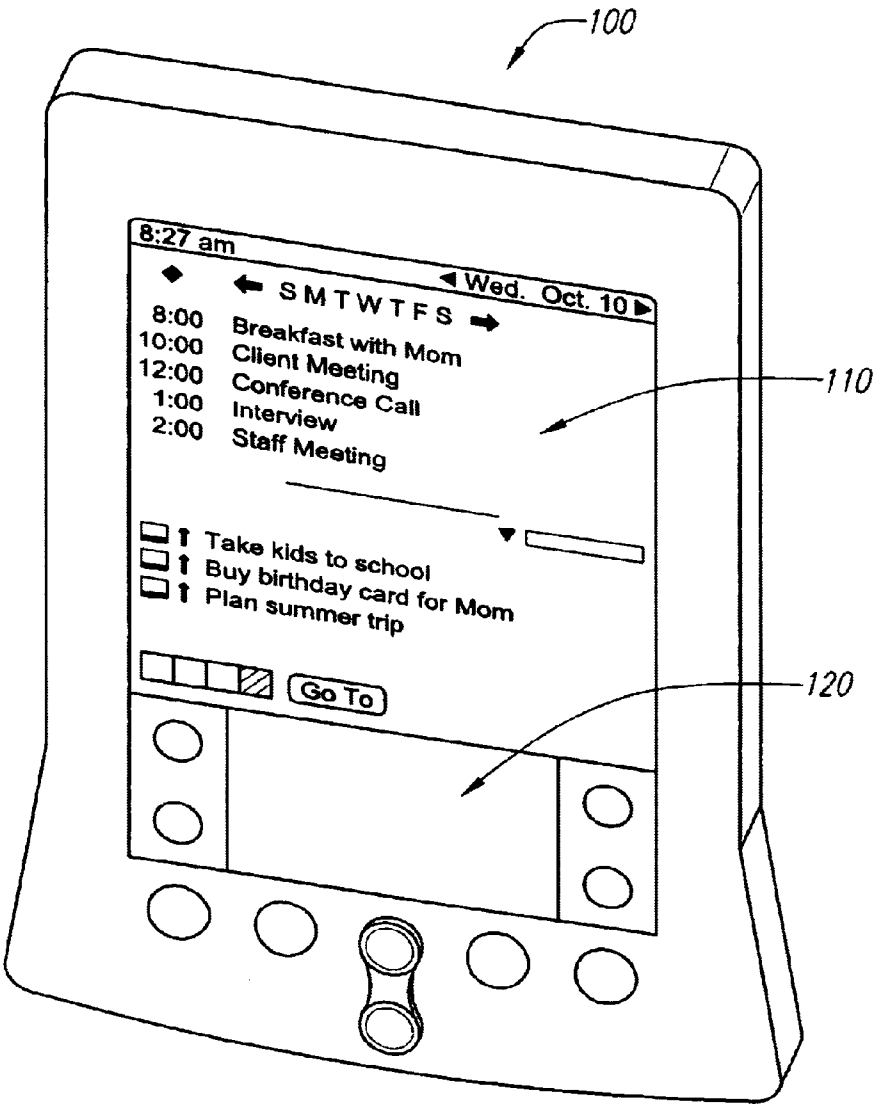

100
8:27 am
Wed. Oct. 10
S M T W T F S
8:00 Breakfast with Mom
10:00 Client Meeting
12:00 Conference Call
1:00 Interview
2:00 Staff Meeting
110
Take kids to school
Buy birthday card for Mom
Plan summer trip
Go To
120

FIG. 1

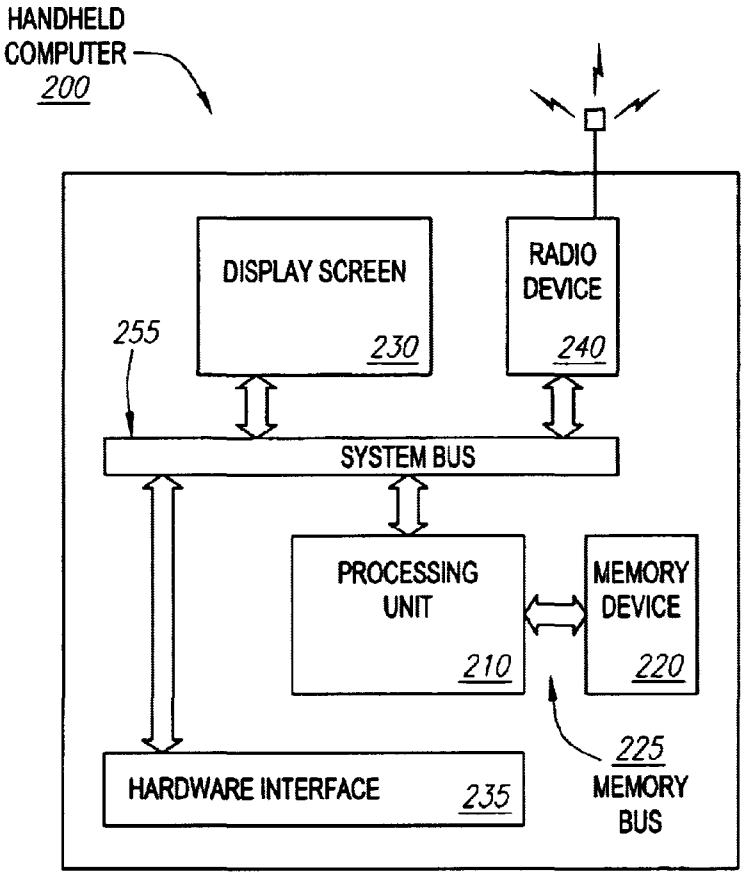

HANDHELD COMPUTER
200
DISPLAY SCREEN
230
RADIO DEVICE
240
255
SYSTEM BUS
PROCESSING UNIT
210
MEMORY DEVICE
220
225
MEMORY BUS
HARDWARE INTERFACE
235

FIG. 2

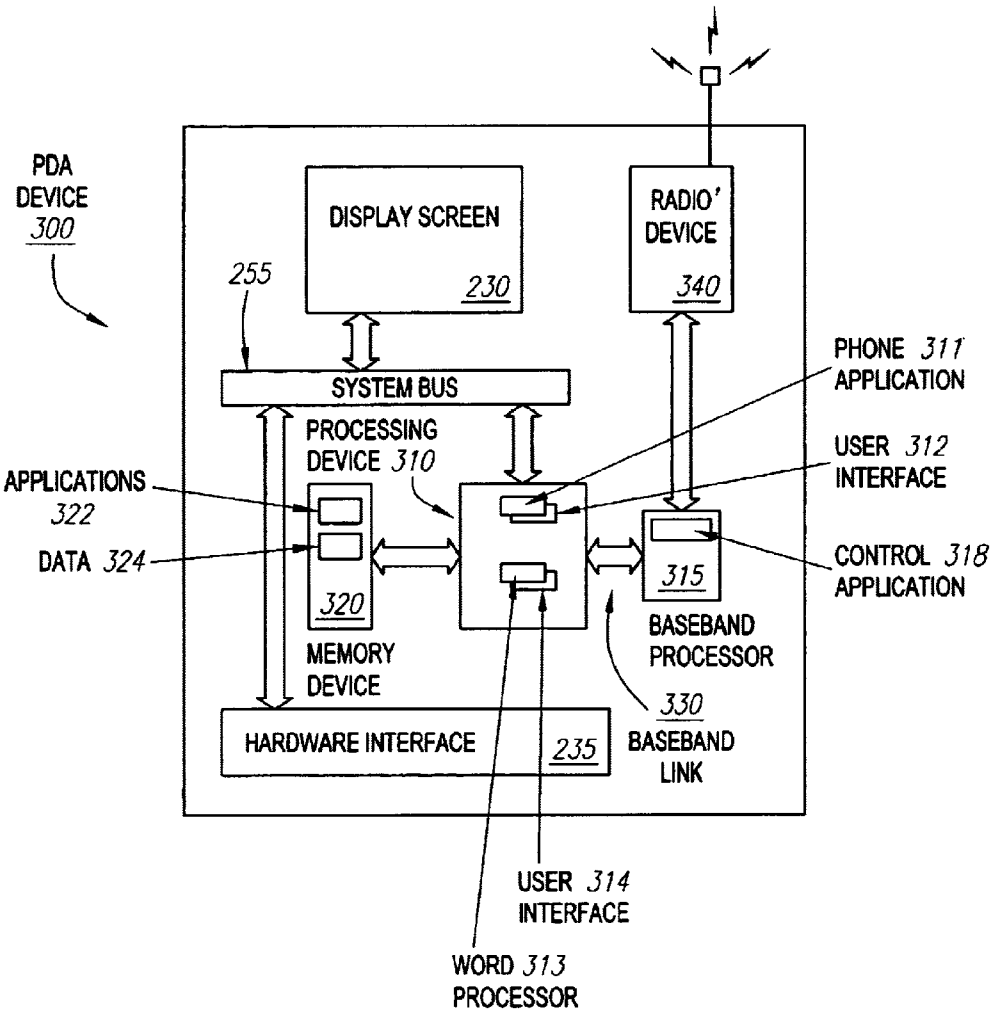

PDA
DEVICE
300
DISPLAY SCREEN
230
RADIO'
DEVICE
340
255
SYSTEM BUS
PHONE 311
APPLICATION
USER 312
INTERFACE
PROCESSING
DEVICE 310
APPLICATIONS
322
DATA 324
320
315
CONTROL 318
APPLICATION
BASEBAND
PROCESSOR
MEMORY
DEVICE
330
HARDWARE INTERFACE
235
BASEBAND
LINK
USER 314
INTERFACE
WORD 313
PROCESSOR

FIG. 3

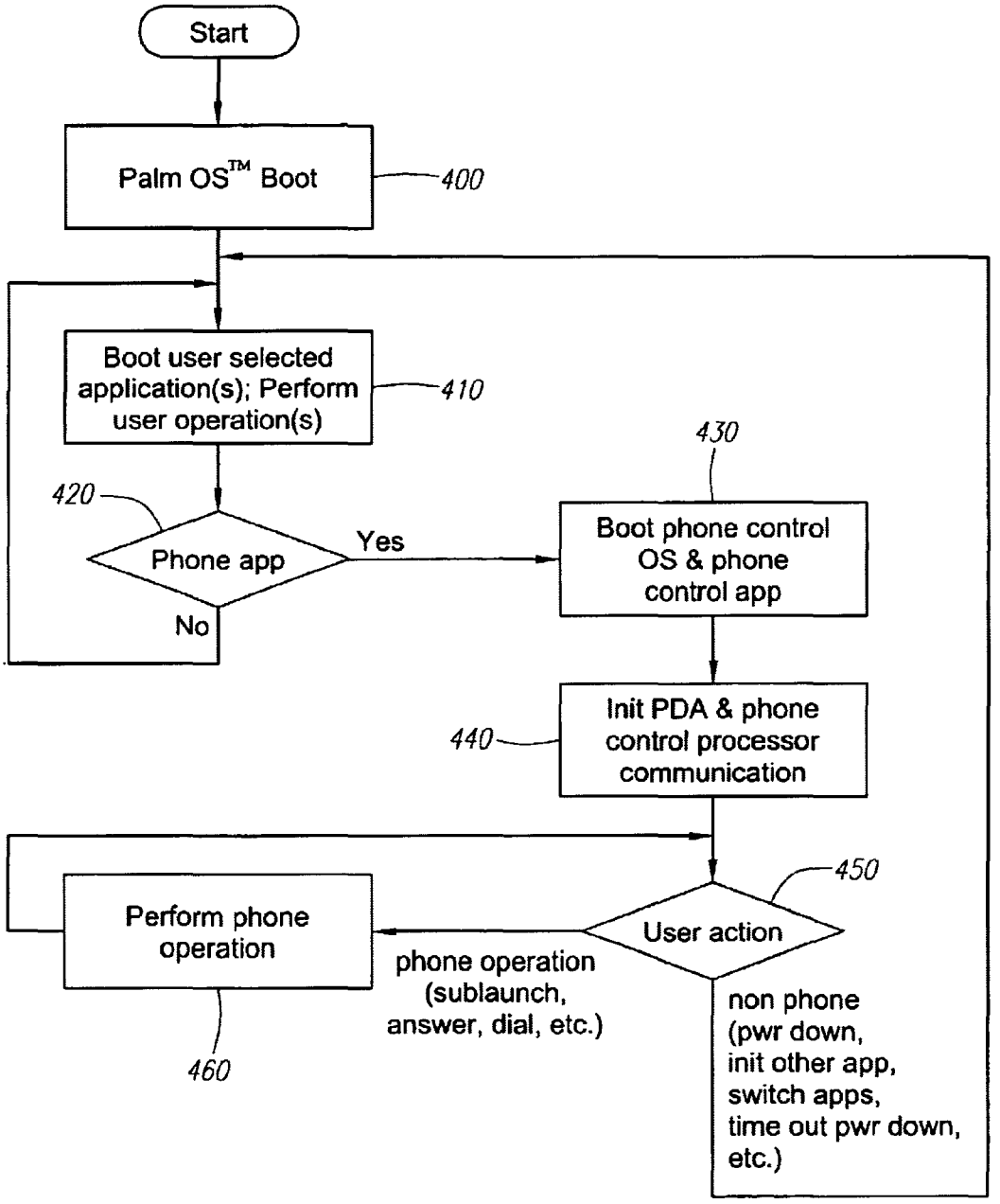

Start
Palm OS™ Boot
400
Boot user selected application(s); Perform user operation(s)
410
420
Phone app
Yes
No
430
Boot phone control OS & phone control app
440
Init PDA & phone control processor communication
450
User action
Perform phone operation
460
phone operation (sublaunch, answer, dial, etc.)
non phone (pwr down, init other app, switch apps, time out pwr down, etc.)

FIG. 4

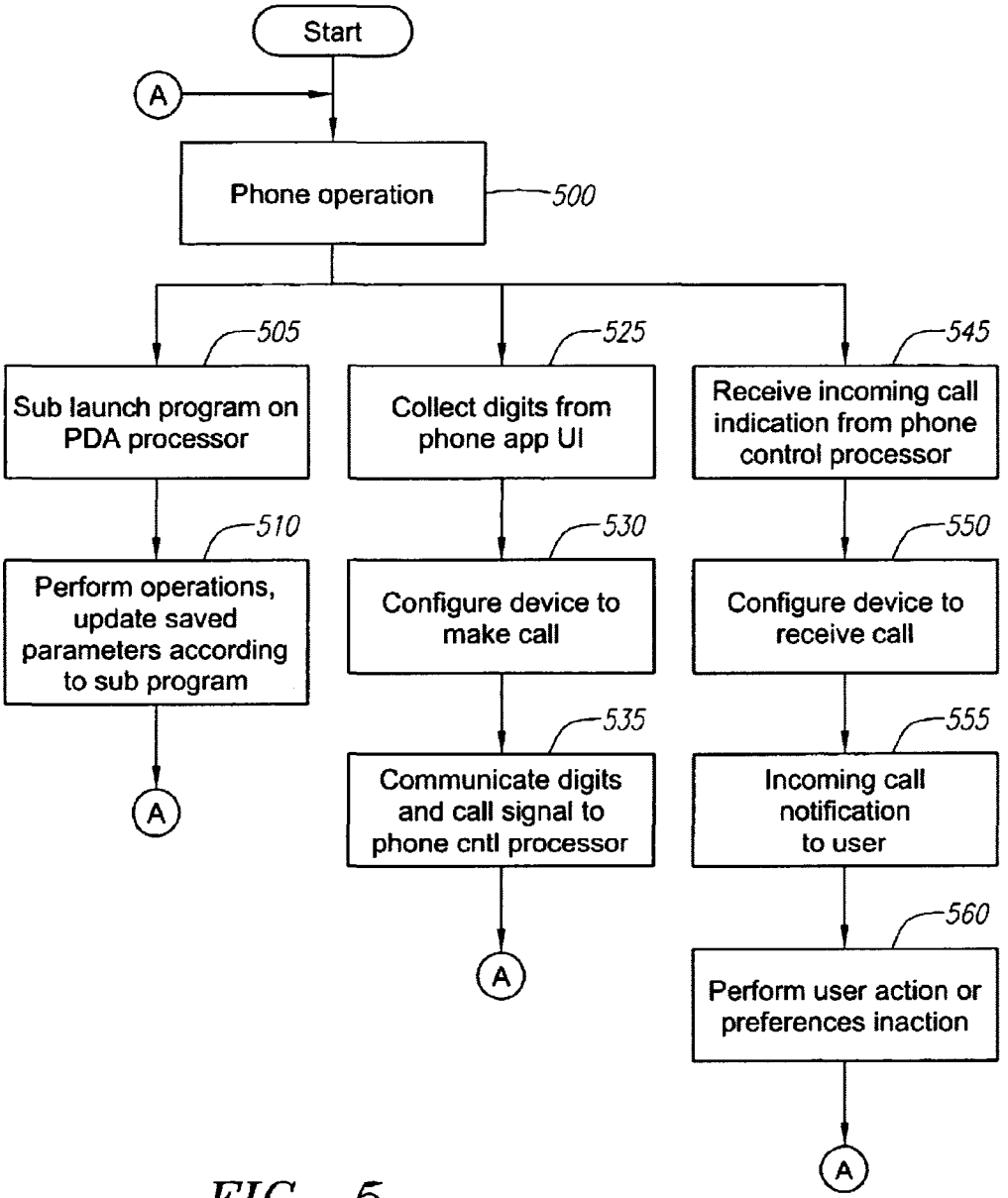

Start
A
Phone operation
500
505
Sub launch program on PDA processor
510
Perform operations, update saved parameters according to sub program
A
525
Collect digits from phone app UI
530
Configure device to make call
535
Communicate digits and call signal to phone cntl processor
A
545
Receive incoming call indication from phone control processor
550
Configure device to receive call
555
Incoming call notification to user
560
Perform user action or preferences inaction
A

FIG. 5

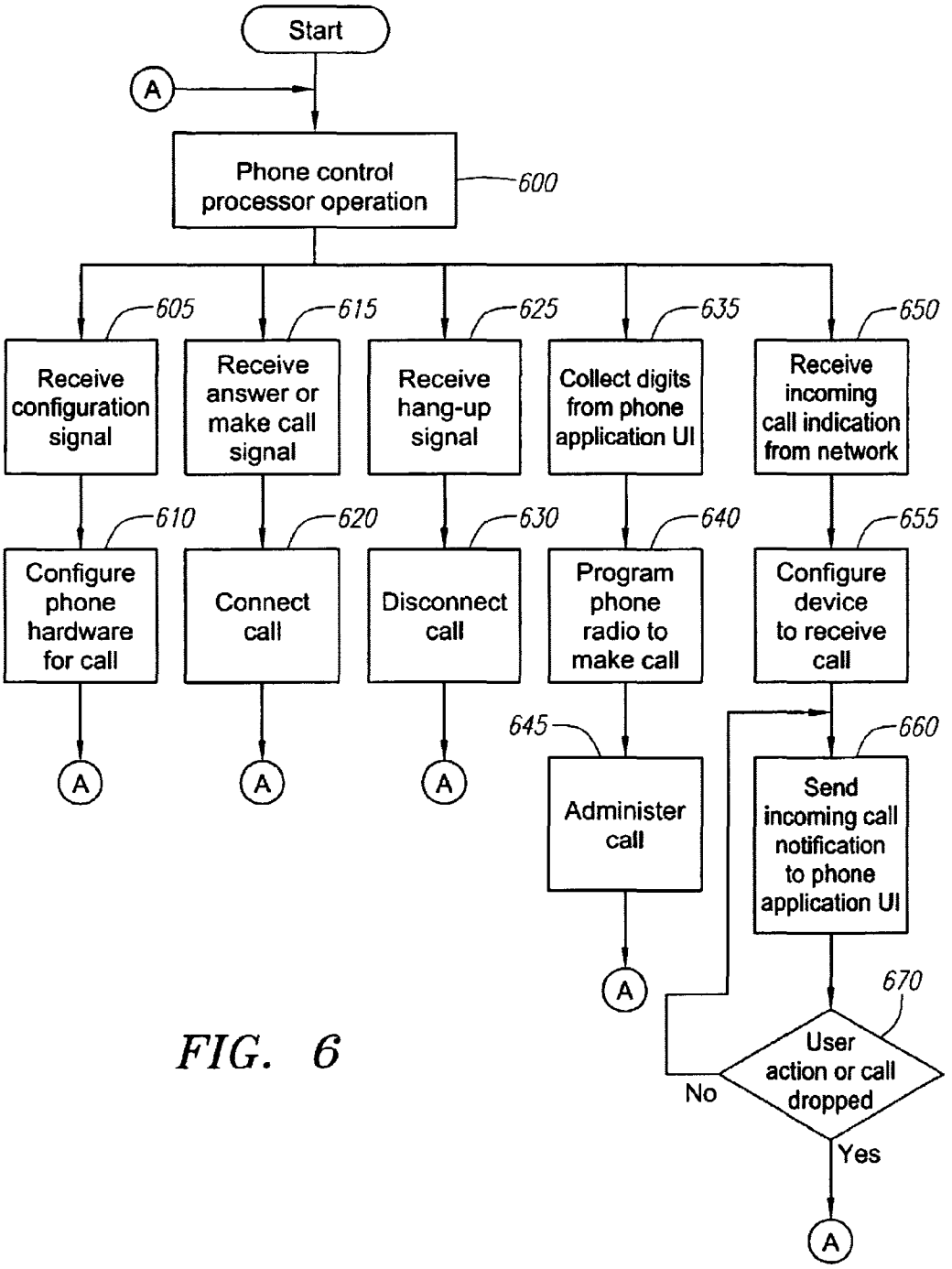

Start
A
Phone control processor operation
600
605
615
625
635
650
Receive configuration signal
Receive answer or make call signal
Receive hang-up signal
Collect digits from phone application UI
Receive incoming call indication from network
610
620
630
640
655
Configure phone hardware for call
Connect call
Disconnect call
Program phone radio to make call
Configure device to receive call
645
660
Administer call
Send incoming call notification to phone application UI
670
User action or call dropped
No
Yes

FIG. 6

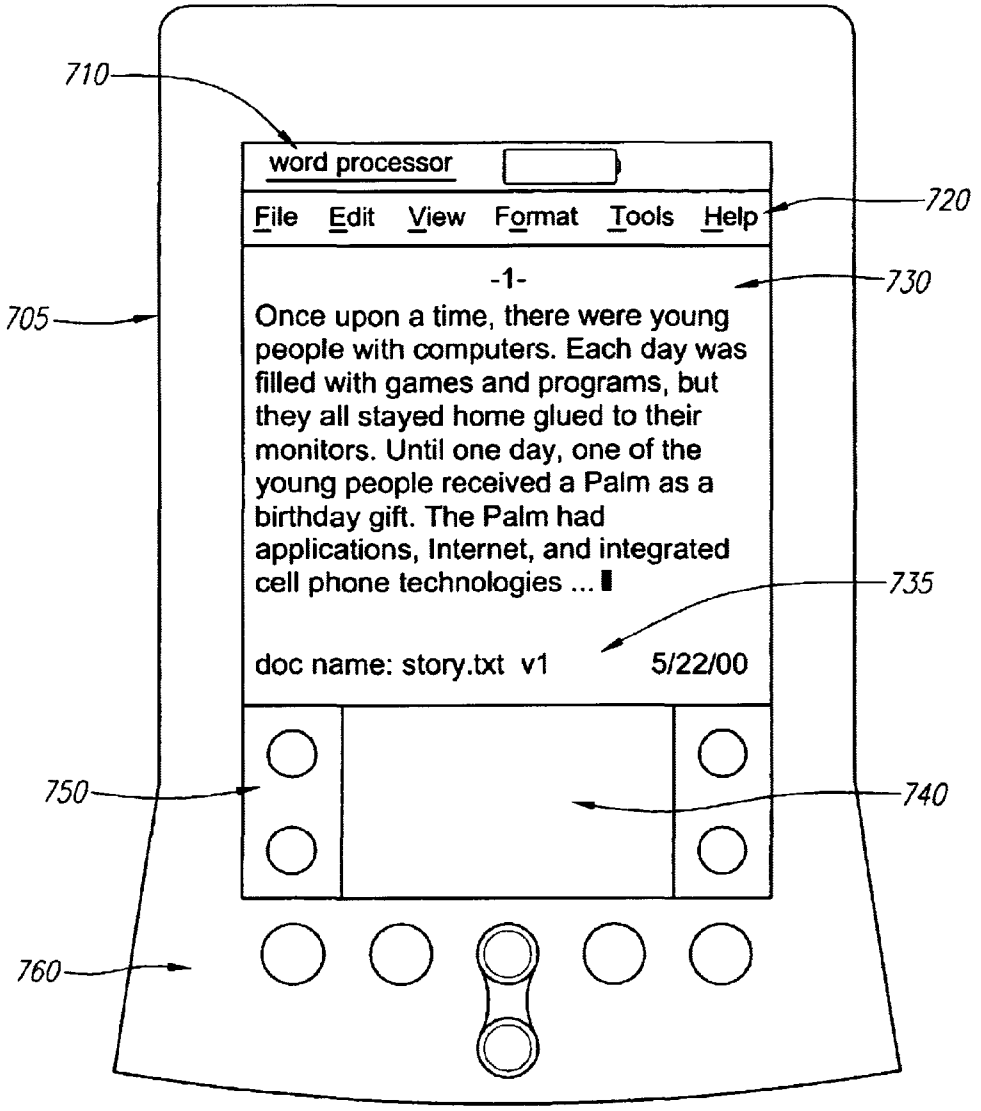

710
word processor
File Edit View Format Tools Help
720
730
705
-1-
Once upon a time, there were young people with computers. Each day was filled with games and programs, but they all stayed home glued to their monitors. Until one day, one of the young people received a Palm as a birthday gift. The Palm had applications, Internet, and integrated cell phone technologies ...
735
doc name: story.txt v1 5/22/00
750
740
760

FIG. 7

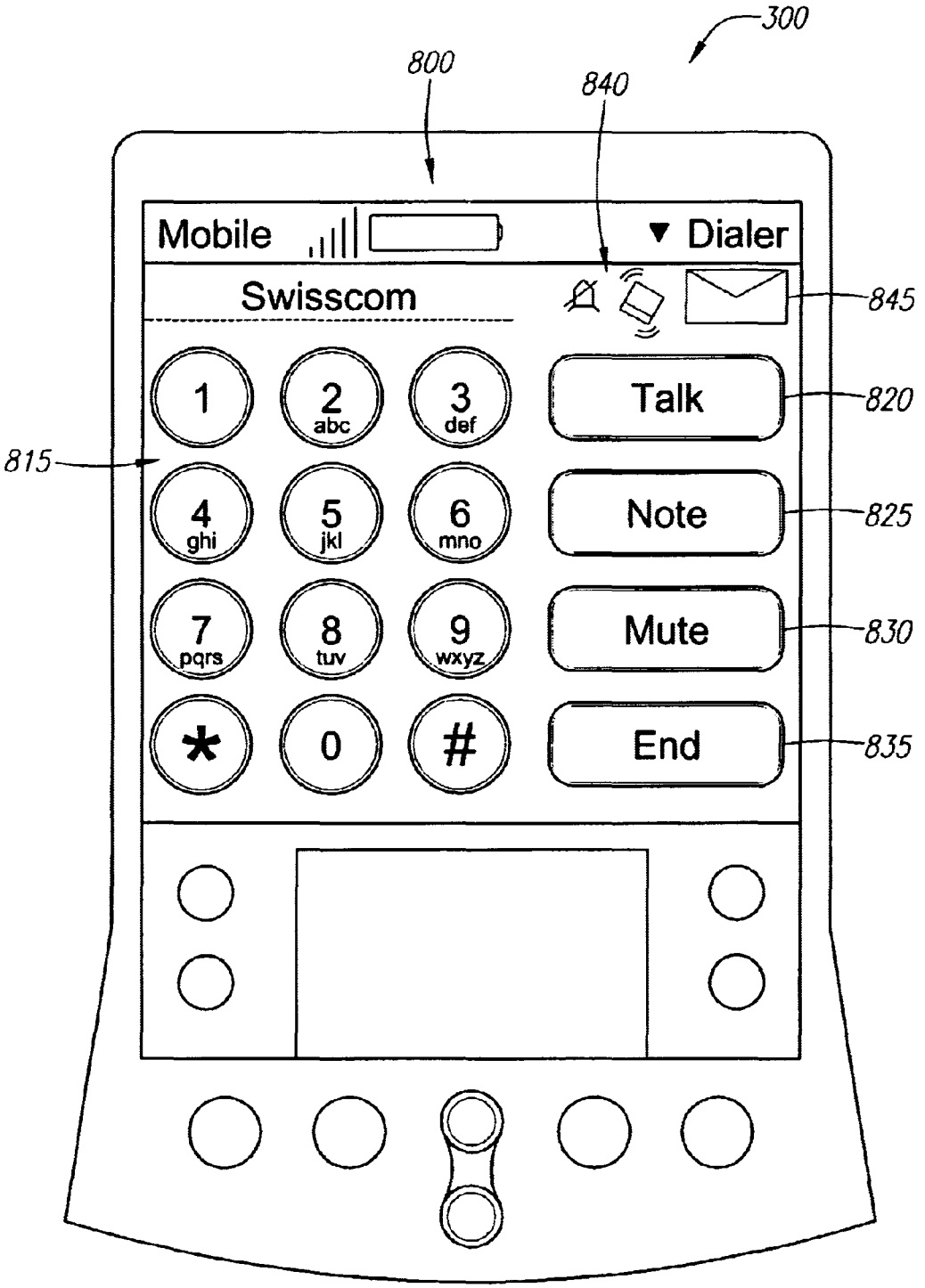

300
800
840
Mobile
Dialer
Swisscom
845
1
2 abc
3 def
Talk
820
815
4 ghi
5 jkl
6 mno
Note
825
7 pqrs
8 tuv
9 wxyz
Mute
830
*
0
#
End
835

FIG. 8

METHOD AND APPARATUS FOR INTEGRATING PHONE AND PDA USER INTERFACE ON A SINGLE PROCESSOR

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BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates generally to user interfaces. The invention is more particularly related to user interfaces for phone and Personal Digital Assistants (PDAs). And, the invention is yet more particularly related to combining phone and PDA user interfaces on a single processing device.

2. Discussion of Background

Personal computer systems and their applications have become common tools in modern society. To organize their lives, many personal computer users use personal information management applications such as an address book and a daily organizer on their personal computers. Although such applications have proven useful for personal information management, their utility is limited by the fact that the person must be sitting at their personal computer system to access the information.

To remedy this limitation, palmtop computers, electronic organizers and other handheld devices, commonly known as personal digital assistants (PDA's), have been introduced. The PDA is a computer that is small enough to be handheld or placed in a pocket, and allows a user and run various applications including personal information management applications such as address books, daily organizers, etc. These applications make people's lives easier.

The most popular brand of PDA is the Palm™. However, the Palm™ is much more than a simple PDA. A basic configuration of the Palm™ **100** is shown in FIG. **1**. This small, slim, device, about the size of your wallet, can hold 6000 addresses, 5 years of appointments, 1500 to-do items, 1500 memos, 200 e-mail messages, and can run many different software applications.

The front of the Palm™ **100** is a large LCD screen **110** which is touch-sensitive and allows a user to enter and manipulate data. A stylus (not shown) is provided with the Palm™ to help in making touch screen inputs. By using the stylus (or another handheld pointer) to interact with a touch-sensitive screen, a palmtop user can easily navigate through a host of built-in programs, software, and other applications.

Today, the Palm™, PDA and other handheld computing devices offer Internet connectivity capabilities, as well as a vast array of hardware and software choices. Palmtops have evolved from simple organizers into a new kind of handheld that people use to instantly manage all kinds of information, from email, to medical data, to stock reports.

Mobile telephones (cell phones, PCS, satellite phones, etc) are also common tools in today's world. Many cell phones include rudimentary functionality for maintaining call lists, or phone book information, to help alleviate the burdens associated with managing contacts and tracking phone numbers.

However, despite the great capabilities and conveniences of the modern PDA, and the cell phone, many innovations are needed for expanding the capabilities and for increasing the convenience of using PDAs and cell phones.

SUMMARY OF THE INVENTION

The present inventors have realized that the integration of mobile telephone technology into a PDA is one area where innovations are greatly needed to improve the performance, convenience, and usability of PDA and/or other devices having mobile telephone capabilities. The present inventors have also realized that the integration of cell phones into a PDA have some drawbacks that make operation of the combined devices less efficient. For example, a PDA having an integrated cell phone has more processing capability than needed, if the cell phone is simply added to the PDA. A PDA having integrated cell phone capability which uses a single processor to run both the cell phone and PDA is subject to invalid, spurious, rogue, or hacker initiated signals if the PDA processor runs user programs and controls the radio functions of the cell phone.

The present invention is a PDA or other electronic device having integrated cell phone technology. The user interfaces for the cell phone and the PDA are run on a single main processor (PDA processor, for example). A second, phone control processor controls the radio functions of the cell phone. A proprietary link is established for communications between the PDA processor and phone control processor. The proprietary link isolates the phone control processor and radio equipment of the cell phone from spurious commands instituted because of hacker's programs, program crashes, etc., that occur on the PDA processor.

The invention may be embodied as a handheld computer or electronic device comprising, a display screen, a first processor configured to run user applications and send outputs of the user applications to the display screen, the user applications including a telephone user interface configured to capture user inputs for telephone related operations and display current telephone operations information on the display screen, a telephone device, a baseband processor connected to the telephone device and configured to control operations of the telephone device, and a communications link between the first processor and the baseband processor for communicating user inputs and selections from the telephone user interface to the baseband processor.

The invention includes an electronic device comprising display means, a first processing means for running user applications and sending outputs of the user applications to said display screen, said user applications including a user interface means for at least capturing user inputs for telephone related operations and displaying current telephone operations information on said display means, a telephone communication means, a baseband processing means for controlling operations of said telephone communication means, and a link means for communicating data between said first processing means and said baseband processing means, said data including user inputs and selections from said user interface means to said baseband processing means.

The present invention includes a method of operating an electronic device having an integrated telephone device, comprising the steps of, running a telephone user interface program on a first processing device, running a telephone

device control program on a second processing device, communicating user data and actions from the telephone user interface program to the telephone device control program via a communications link between the first processor and the second processor, and controlling operation of the integrated telephone device via the telephone device control program according to the user data and actions communicated.

Portions of the present invention may be conveniently implemented on a general purpose computer, such as a modern PDA, Palm™, cell phone, satellite phone, or networked computers, and the results may be displayed on an output device connected to any of the general purpose, PDA, Palm™, networked computers, or transmitted to a remote device for output or display.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. **1** is a Palm™ handheld computer;

FIG. **2** is a block diagram of selected components of a possible design integrating cell phone technology into a PDA device;

FIG. **3** is a block diagram of selected components of a design according to an embodiment of the present invention for integrating cell phone technology into a PDA device;

FIG. **4** is a flow chart illustrating process flows of a main PDA processor executing PDA and cell phone user interfaces;

FIG. **5** is a flow chart illustrating an embodiment of process flows of a cell phone user interface and communications of the cell phone user interface to a phone control processor according to the present invention;

FIG. **6** is a flow chart illustrating an embodiment of a phone control program according to the present invention;

FIG. **7** is an electronic device running a PDA application according to an embodiment of the present invention; and

FIG. **8** is an electronic device running a phone application according to an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring again to the drawings, wherein like reference numerals designate identical or corresponding parts, and more particularly to FIG. **2** thereof, there is illustrated a block diagram of selected components of a handheld computer **200** that includes cell phone technology. The handheld computer **200** includes a processing device **210**, for executing applications and an operating system of the computer **200**, a memory device **220** for storing the operating system, data, and the applications. A memory bus **255** is utilized to transfer programs and data from memory to the processing unit **210**.

A display screen **230** is provided (preferably a touch sensitive screen) for display of Operating System prompts, buttons, icons, application screens, and other data, and for providing user inputs via tapping or touching (or drawing in the Graffiti™ area **120**) via a stylus or other touch mechanism. Hardware interface **235** connects to physical hard buttons and switches located on a body of the computer **200** and provides signals to applications running on the processing unit **210**.

A mobile radio device **240** provides connectivity to a cellular telephone network (not shown). A system bus **255** carries data and commands to/from the processing unit **210** from/to other devices within the computer **200**. For example, user applications running on the computer **200** send application screens and other data outputs to display screen **230** for display via the system bus **255**. User inputs (Graffiti™ area drawing, or tap selection, for example) are detected by the screen **230** and sent to the processing unit **210** via the system bus **255**.

In addition to the operating system and user selected applications, another application, a phone device, executes on the processing unit **210**. Phone calls from the network directed toward the mobile radio device **240** are detected by the mobile radio device and sent, in the form of an incoming call notification, to the phone device (executing on the processing unit **210**). The phone device processes the incoming call notification by notifying the user by an audio output such as ringing (not shown).

The phone device also includes a method for the user to answer the incoming call. For example, tapping on a phone icon, or pressing a hard button designated or preprogrammed for answering a call signals the phone device to send instructions (via system bus **255**) to the mobile radio device **240** to answer the call.

Outgoing calls are placed by a user by entering digits of the number to be dialed and pressing a call icon, for example. The dialed digits are sent to the mobile radio device **240** along with instructions needed to configure the mobile radio device **240** for an outgoing call. The instructions may include, for example, 1. Access a base station, 2. Send digits, 3. Retrieve and forward ring indication (if any), 4. Connect call, 6. manage call, and 7. await further instructions. Many other instructions may be utilized. For example, in the AT command set more than 100 commands are available. Similar instructions may be sent for handling an incoming call by the phone device after receiving and processing an incoming call indication from the mobile radio device **240**.

The mobile radio device **240** is a device configured send signals on exact frequency requirements (FCC certified, for example). Base stations that communicate with the mobile radio device **240** are also precision devices sending and receiving on specified radio frequency channels. One difficulty arising with the design as shown in FIG. **2** is that application program crashes on processor **210** can cause unwanted or inconsistent signals to be generated on system bus **255** and potentially causing problems with the mobile radio device **240**, such as spurious radio emissions. In addition the design of FIG. **2** also is susceptible to hacker or rogue programs that may be executing on processing unit **210**, also potentially causing spurious radio emissions from mobile radio device **240**. The potential spurious emissions, might, for example, cause radio broadcasts in an unintended or unapproved frequency range, potentially cause problems at one or more base stations (unintentionally causing a base station re-boot, for example), or cause interfere with other mobile radio devices.

FIG. **3** is a block diagram of selected components of a design according to an embodiment of the present invention for integrating cell phone technology into a PDA device **300**. The PDA device **300** is a handheld computer such as a Palm™, Palm III™, or Palm V™, or Palm VII™ organizers, manufactured by Palm, Inc. Other embodiments of the invention can include Windows CE™ and Visor™ handheld computers, or other handheld computers and personal digital assistants (PDAs).

Preferably, the PDA **300** has interactive hardware and software that perform functions such as maintaining calendars, phone lists, and at least one voice or audio related functions integrated or attachably integrated (via a connector device, for example, not shown) so as to be configured for use with cellular telephone capabilities of the PDA. Several examples of a configuration and details of connector devices for connecting or integrating voice function devices to a PDA are described in Maes et al., application Ser. No. 09/675,872, entitled, "INTEGRATING VOICE FUNCTION INTO A PDA," filed Sep. 29, 2000, the contents of which are incorporated herein by reference in their entirety.

The software, including a phone user interface, operating system, and other applications (word processors, spreadsheets, databases, etc.) **322** are stored in memory device **320**, along with program data, graphics, and other data **324**, and executed on a processing device **310**. A touch sensitive display device **230** and hard button interface **235** are also provided as similarly discussed above. A system bus **255** provides data, command, and possibly other types of communication, as directed, by any one of the devices, including display screen **230**, hardware interface **235**, and processing unit **310**, to the other devices.

Processing unit **310** runs applications, including the operating system (OS, including a User Interface (UI) of the OS), and other user applications (word processor **313** and word processor user interface **314**, for example) as directed by user inputs. The user applications display outputs on the display screen **230** and receive inputs from taps, tap & hold, and writing operations on the display screen and from programmed hard buttons attached to hardware interface **235**.

FIG. **3** includes a mobile radio device **340**, and a phone control processor **315**. The mobile radio device **340** receives instructions and other control data from the phone control processor **315** (also referred to as a baseband processor), implementing those instructions and using the data so as to operate the mobile radio device **340**. The phone control (baseband) processor **315** sends instructions and data to the mobile radio device based on programming of a phone control application **318**.

A phone application **311** and phone application user interface **312** are provided and execute on the processing unit **310**. The main function of the phone application **311** is to service the phone application user interface **312** and transfer required data to and from the phone control application **318** running on the phone control (baseband) processor **315**.

A PDA/baseband link **330** is used to communicate data between the phone application **311** (on processing unit **310**) and the phone control application **318** (on phone control (baseband) processor **315**). The PDA/baseband link **330** is an AT Command interface over a serial link. The PDA/baseband link **330** separates processing performed on processing unit **310** and processing performed on the phone control (baseband) processor **315**, providing a separation that reduces chances that a hacker program, other rogue application, or a program crash on the processing unit **310** has any improper influence on the phone control (baseband) processor **315** or the phone control application **318**, hence providing a more stable environment for operation of the mobile radio device **340** and assuring no adverse impact on the operation of the cellular network (e.g., preventing unwanted interference signals that could adversely affect other users).

In one embodiment, the AT Command over serial link used on the PDA/baseband link **330** is proprietary to Palm™ and/or utilizes other protocol stacks. In other embodiments, the PDA/baseband link **330** is a parallel interface. In the embodiments using a proprietary link (proprietary protocol and/or proprietary protocol stack), the format of the proprietary link is not particularly important over and above normal protocol considerations (byte economy, ease of use, etc), but keeping the link proprietary assures that rogue applications affecting operation of other PDA devices are unlikely to have any effect on a device according to the present invention. The PDA/baseband link **330** includes a protocol that is updateable by downloading an updated protocol from a vendor web site and installing the updated protocol on each of the processing unit **310** and phone control (baseband) processor **315**.

The type of interface used over the PDA/baseband link **330** may be selected based on criteria of the phone control (baseband) processor **315** which may already have communication ports configured for either parallel or serial communications. The selected protocol is a choice between the available protocols for a particular baseband processor, or a protocol that may be developed by the producer of the baseband processor and the producer of a device utilizing the present invention. No advantage in the type of protocol utilized is envisioned, except that an industry standard protocol (such as the AT command interface discussed above) may be more familiar to development engineers implementing a product, and may reduce development time.

FIG. **4** is a flow chart illustrating process flows of a main PDA processor executing PDA and cell phone user interfaces. At step **400**, the system (handheld computers, Palm™, etc.) is powered on and the Palm™ OS is booted. The Palm OS™ is used as an example, other handheld or full service operating systems (NT, Windows, Linux, etc.) may be utilized. Steps **410** and **420** are combination steps.

At step **410** any user operation may be performed (power down, set preferences, arrange icons, etc.) or user selected application (word processor, Internet, etc.) may be invoked and used. Step **420** identifies that the user has selected a phone application that is intended to control mobile phone capabilities built into the system (mobile radio **340**, for example).

When the phone application is started, it sends a signal across the PDA/baseband link **330** that signals the phone control OS to boot and start a phone control application that runs on the phone control processor (step **430**). Alternatively, the phone control OS is booted upon power up of the system and waits in a hibernation state until a signal is received to start the phone control application. In the former case, an on/off recognizer identifies whether a signal on the PDA/baseband link **330** is an on/off command and boots or shuts down the phone control OS and processor accordingly. In the latter case, the phone control OS recognizes start and shut down commands that are applied to the phone control application.

Once started, the PDA processor unit and phone control processor begin communicating from phone application to phone control application over the PDA/baseband link **330** (step **440**). User actions (step **450**) controlling PDA functions or directly phone operations (step **460**) are implemented.

FIG. **5** is a flow chart illustrating some example phone operations. The user initiates various phone operations (step **500**) by tapping phone application icons, graphics, enters control data into the Graffiti™ area, or other input method attached keyboard, hard buttons, etc.). Phone operations may include, for example, sub-launching a phone related

application (step **505**) and performing the sub-application processed (sub-launching an address book or note taking function (step **505**), and updating/creating an address book entry or taking/updating a note (step **510**), for example. One example of a note taking application is described in Maes et al., U.S. Pat. No. 6,442,251, application Ser. No. 09/675,363, entitled, "METHOD AND APPARATUS FOR TAKING A NOTE WHILE IN A CALL," filed Sep. 29, 2000, the contents of which are incorporated herein by reference in their entirety.

Another example phone operation is making a call, illustrated in steps **525–535**. First, the phone application collects digits entered by the user via the phone application user interface (running on PDA processing unit **310**) (step **525**). A step of sending a wake up or configuration signal (step **530**) to the phone control application (running configuration signal (step **530**) to the phone control application (running on phone control processor **315**) may be performed to "wake" the phone control application **318** (in the case where the phone control application **318** is in a sleep mode from a period of in-operation, for example) and signal the phone control application **318** to configure the mobile radio device **340** so as to be ready to make a call (power up, awake form sleep, etc.). Step **530** may be performed as soon as the phone application knows that a call is being made, such as up on phone application boot, or when a first digit of a phone number is received (as in step **525**, for example). At step **535**, the digits collected at step **525** are communicated from the phone application to the phone control application, signaling the phone control application to initiate a call to that number.

Another example phone application is receiving an incoming call as illustrated in steps **545–560**. At step **545**, an incoming call indication is received by the phone application from the phone control application (running on ph call processor). At step **550**, the phone application is configured to receive the call (set up audio channels, "wake" phone applications, etc.). At step **555**, the phone application presents an incoming call notification to the user (ringing, vibration, visual display, combination, etc.). Finally at step **560**, a user acts to answer the call (presses a talk button or icon, for example), which directs the phone application to connect the call, or, a user acts to send the call to voicemail (or ignore), by pressing an end button or icon, for example. Alternatively, if a user does nothing, the call is left unattended (call directed to voicemail by network, for example), or, if the user has preferences set, the preferences are used to direct operations of the phone application. Examples of user preferences for directing phone operations during periods of user inaction (and other conditions, such as how to notify a user of an incoming call) are described in Maes et al.; application Ser. No. 09/675,874, entitled, "METHOD AND APPARATUS FOR SETTING AND USING USER PREFERENCES," filed Sep. 29, 2000, the contents of which are incorporated herein by reference in their entirety.

FIG. **6** is a flow chart illustrating an embodiment of a phone control program according to the present invention. Several processes are shown, as sequential processes initiated by an event or control signal. One example operation, configuring the mobile radio device **340** to make a call, is initiated, for example, by a control signal received (step **605**) via the PDA/baseband link **330** from the phone application. The phone control processor **315** performs the configuration (step **610**). Another example includes signals received by the phone control processor directing it to answer a call (step **615**), and the operations of the control processor needed to connect the call (step **620**) are performed. Similarly, a signal may be received to hang-up a current call (step **625**), and the phone control processor disconnects the current call accordingly (step **630**).

Another example operation of the phone control processor is shown in steps **635–645**, for making a call. The phone control processor receives a communication from the phone application having the digits of a user entered telephone number (step **635**), the phone control processor programs the mobile radio device **340** to contact a base station and initiate the call (step **640**), and the phone control application administers (performs any functions needed to maintain the connection) the call (step **645**).

A final example operation, answering an incoming call, is illustrated in steps **650–670**. An incoming call indication is received from the network (step **650**). The phone control processor configures the mobile radio device to answer the call (step **655**) and sends an incoming call notification to the phone application (step **660**). If a user action prompted action message (hang-up, send to voicemail, or answer, for example) is returned from the phone application, a phone control application process is then initiated (downstream from connector A) to perform that process. If no user action is occurs, the incoming call notification is resent (no branch of step **670**).

Alternatively, the phone application is pre-programmed to continue any ringing (or other notification) until a lost call signal is received from the phone control application indicating that there is no longer an incoming call (already diverted to voice mail by the network, or caller hung-up, for example). The above processes are examples, and other features or processes may also be performed by the phone control processor (periodic network checks, or sending network ID information to the phone application, for example).

FIG. **7** is an electronic device running an example PDA application according to an embodiment of the present invention. The example PDA application is a word processor **705** that runs on processing unit **310**. The word processor includes an identification banner **710**, a set of pull down menus **720** for file management and other features of the word processor **705**. The document being processed **730** is displayed, and user inputs are received via tapping the touch sensitive screen, writing or other actions in the Graffiti™ area **740**, tapping virtual buttons **750**, or pressing one or more hard buttons **760** (some of which may be connected via Hardware interface **235** and programmed for initiating a specific function of the word processor, for example). The document being processed is saved as storyl.txt (as shown by document identifier **735**) in memory device **320**.

Concurrently hosted on the Palm™ (or electronic or computer device) **300** is the phone application. An example phone application **800** is shown in FIG. **8**. The phone application **800** includes a dialer screen **815** that includes keypad digits 1–9, *, and #, and a set of operation keys. The operation keys include Talk **820**, Note **825**, Mute **830**, and End **835**. In one embodiment, user activation of the Talk key **820** initiates a phone call of previously entered digits, or answers an incoming call. User activation of the Mute key **830** mutes the caller at the other end of the line (other caller), which keeps the other caller from hearing any conversation initiated at the users side of the call. User activation of the End key **835** terminates the call that the user is currently participating, or immediately transfers an incoming call to voicemail (or other options as specified in user preferences, for example). Other functions may be assigned or programmed into the keys, and additional or alternative keys

and functions may also be provided. The Palm OS™ (or other operating system) decides which of the concurrent applications is currently being executed on the processing device **310**, the remain application(s) in an inactive state.

While on a call, the Note key **825** activates an in-call note taking service, allowing the user to take notes about the call and return to the dialer screen for control of other telephone options after completing the note. Details of a note options are described in co-pending U.S. patent application No. 09/675,363, entitled "METHOD AND APPARATUS FOR IN A PHONE CALL," filed Sep. 29, 2000, the contents of which are incorporated by reference in their entirety.

A voicemail flag **845** (envelope icon, for example) indicates a voicemail or other message (short messaging service, for example) received by the phone application or network administering the telephone capabilities of the Palm™ **300**. Ringer preferences are shown as two icons **840** (a bell with a line drawn through it, and a vibrator icon) illustrating the current options for notification of incoming calls. Either the bell icon or vibrator icon may be tapped to change the status of the option. For example tapping the bell with a line drawn through it changes it to bell without a line. Tapping the vibrator icon changes it to a no vibrate icon. In this manner, user preferences, or options, may be changed. The phone application **810** is one example of a phone application that may be utilized in conjunction with the present invention. However, it should be understood that variations and/or other phone applications may be utilized.

FIGS. **7** and **8** illustrate concurrent applications, and their respective user interfaces, executing on the processing unit **310**. However, control of the mobile radio device **340** is maintained by the phone control processor, and the phone control application. In effect, separating user applications and interfaces and the phone application user interface from having any influence over the operation of the phone control application, thereby isolating the phone control application for any ill effects of a rogue application or program crash on the processing unit **310**.

Although the present invention has been described using the specific example of integrating phone and PDA user interfaces on one processor and maintaining phone control on a separate processor, the invention may be applied to applications other than phone and PDA based systems. For example, combining a wireless internet device (replacing **340**) and another electronic device (e.g., PDA, electronic inventory system, etc.), or any other wireless communication system and another electronic device, each having a user interface.

Portions of the present invention may be conveniently implemented using a conventional general purpose or a specialized digital computer or microprocessor programmed according to the teachings of the present disclosure, as will be apparent to those skilled in the computer art.

Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those skilled in the software art. The invention may also be implemented by the preparation of application specific integrated circuits or by interconnecting an appropriate network of conventional component circuits, as will be readily apparent to those skilled in the art.

The present invention includes a computer program product which is a storage medium (media) having instructions stored thereon/in which can be used to control, or cause, a computer to perform any of the processes of the present invention. The storage medium can include, but is not limited to, any type of disk including floppy disks, mini disks (MD's), optical discs, DVD, CD-ROMS, micro-drive, and magneto-optical disks, ROMs, RAMs, EPROMs, EEPROMs, DRAMs, VRAMs, flash memory devices (including flash cards), magnetic or optical cards, nanosystems (including molecular memory ICs), RAID devices, remote data storage/archive/warehousing, or any type of media or device suitable for storing instructions and/or data.

Stored on any one of the computer readable medium (media), the present invention includes software for controlling both the hardware of the general purpose/specialized computer or microprocessor, and for enabling the computer or microprocessor to interact with a human user or other mechanism utilizing the results of the present invention. Such software may include, but is not limited to, device drivers, operating systems, and user applications. Ultimately, such computer readable media further includes software for performing the present invention, as described above.

Included in the programming (software) of the general/specialized computer or microprocessor are software modules for implementing the teachings of the present invention, including, but not limited to, placing and receiving telephone calls, transferring audio and voice data, serial, parallel and proprietary communications between processors, user interfaces, and the display, storage, or communication of results according to the processes of the present invention.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. An electronic device comprising:

a display screen;

a first processor configured to run user applications and send outputs of the user applications to said display screen, said user applications including a telephone user interface configured to capture user inputs for telephone related operations and display current telephone operations information on said display screen;

a telephone device;

a baseband processor connected to said telephone device and configured to control operations of said telephone device; and

a communications link between said first processor and said baseband processor for communicating user inputs and selections from said telephone user interface to said baseband processor;

wherein said communications link is a proprietary protocol stack.

2. The electronic device according to claim **1**, wherein said communications link is an AT Command interface over a serial link.

3. The electronic device according to claim **1**, wherein said communications link is a parallel interface.

4. The electronic device according to claim **1**, wherein:

said baseband processor comprises,

a baseband processing unit, and

a phone control program configured to execute on said baseband processing unit;

said first processor includes a user interface program configured to retrieve user inputs; and

said phone control program is configured to,

receive data communicated across the communications link, and

control operations of said telephone device.

5. The electronic device according to claim **4**, wherein said data communicated across the communications link includes data identifying any of phone numbers, data setting network user preferences, and call actions, including any of answer call, make call, and hang-up call.

6. The electronic device according to claim **4**, wherein:

said phone control program is further configured to send data identifying current conditions of said telephone device to the user interface program.

7. The electronic device according to claim **6**, wherein said current conditions include any of incoming calls, incoming call caller id information, network status, and indications of network voicemails received.

8. The electronic device according to claim **1**, wherein:

said electronic device is a PDA; and

said telephone device is a cellular radio integrated within said PDA.

9. An electronic device comprising:

a display screen;

a first processor configured to run user applications and send outputs of the user applications to said display screen, said user applications including a telephone user interface configured to capture user inputs for telephone related operations and display current telephone operations information on said display screen;

a telephone device;

a baseband processor connected to said telephone device and configured to control operations of said telephone device; and

a communications link between said first processor and said baseband processor for communicating user inputs and selections from said telephone user interface to said baseband processor;

wherein said communications link includes a protocol that is updateable by downloading an updated protocol from a vendor web site and installing the updated protocol on each of said first processor and said baseband processor.

10. The electronic device according to claim **9**, wherein the electronic device comprises a wireless Internet device.

11. The electronic device according to claim **9**, wherein the baseband processor comprises a phone control program that boots up upon power-up of the electronic device and waits in a hibernation state until a signal is received to start the phone control program.

12. The electronic device according to claim **9**, wherein the baseband processor is configured to wake phone applications when an incoming call is received.

13. A method of operating an electronic device having an integrated telephone device comprising the steps of:

running a telephone user interface program on a first processing device;

running a telephone device control program on a second processing device;

communicating user data and actions from the telephone user interface program to the telephone device control program via a communications link between the first processor and the second processor;

controlling operation of the integrated telephone device via said telephone device control program according to the user data and actions communicated; and

updating the communications link by,

downloading a protocol utilized by the communications link, and

installing the downloaded protocol in each of the telephone user interface program and the telephone device control program.

14. The method according to claim **13**, further comprising the steps of:

communicating conditions of the telephone device, via said communications link, to the telephone user interface program; and

displaying the conditions of the telephone device on a display of the electronic device.

15. An electronic device comprising:

display means;

a first processing means for running user applications and sending outputs of the user applications to said display screen, said user applications including a user interface means for at least capturing user inputs for telephone related operations and displaying current telephone operations information on said display means;

a telephone communication means;

a baseband processing means for controlling operations of said telephone communication means; and

a link means for communicating data between said first processing means and said baseband processing means;

wherein:

said link means is a proprietary protocol stack; and

said data including user inputs and selections from said user interface means to said baseband processing means.

16. The electronic device according to claim **15**, wherein said link means is an AT Command interface over a serial link.

17. The electronic device according to claim **15**, wherein said link means is a parallel interface.

18. The electronic device according to claim **15**, wherein:

said baseband processing means includes a phone control program;

said first processing means includes a user interface program configured to retrieve user inputs and communicate data related to the user inputs to said phone control program via said link means; and

said phone control program is configured to,

receive data communicated across said link means, and

control operations of said telephone device based on the communicated data.

19. The electronic device according to claim **18**, wherein said data communicated across said link means includes data identifying any of phone numbers, data setting network user preferences, and call actions, including any of answer call, make call, and hang-up call.

20. The electronic device according to claim **15**, wherein:

said electronic device is a PDA; and

said telephone communication means is one of a cellular radio, PCS, and satellite phone.

21. An electronic device comprising:

display means;

a first processing means for running user applications and sending outputs of the user applications to said display screen, said user applications including a user interface means for at least capturing user inputs for telephone related operations and displaying current telephone operations information on said display means;

a telephone communication means;

a baseband processing means for controlling operations of said telephone communication means; and

a link means for communicating data between said first processing means and said baseband processing means;

wherein:

said link means includes a protocol that is updateable by downloading an updated protocol from a vendor web site and installing the updated protocol on each of said first processing means and said baseband processing means; and

said data including user inputs and selections from said user interface means to said baseband processing means.

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