Title: PERSONAL DIGITAL ASSISTANT KEY FOR AN ELECTRONIC LOCK

Abstract: A mechanical interface (84) for a PDA (80) allows the PDA to be positioned in an operative relationship relative to an electronic lock or electronic lockbox (82). The mechanical interface allows the PDA to be used as a key (80) to actuate the lock, by transmitting signals from the PDA to the lock. The PDA retains its normal functionality as a general purpose computer, and the interface can also form part of a link between the PDA and a remote computer (88) and/or database (92).
Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

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PERSONAL DIGITAL ASSISTANT KEY FOR AN ELECTRONIC LOCK

Field of the Invention

The present invention relates to electronic lock systems and personal digital assistants (PDAs), and more particularly relates to methods and systems in which electronic lock systems and PDAs can be used together.

Background of the Invention

U.S. Patents Nos. 5,654,696 and 5,475,375 disclose electronic security systems in which a general purpose PDA, which is also referred to as a palmtop computer, is used as a key. In the detailed systems, no modification is made to the PDA; the PDA and lock communicate via standard infrared ports. The lock opens if the correct signals are communicated to it by the PDA.

While advantageous in many respects, the systems detailed in those patents have certain limitations. For one, the locks must have infrared interface capabilities. While such capabilities can be incorporated into new locks, the large installed base of existing locks without infrared capability cannot be used in such systems. (A sampling of such locks is shown in U.S. Patents Nos. 4,727,368, 4,766,746, 5,280,518, 5,550,529, and 5,758,522.) For example, many conventional electronic locks (and electronic lock boxes) have a mechanical interface by which the key is positioned in close proximity or physical contact with the lock for subsequent electronic communication between the lock and the key. Conventional PDAs are not directly compatible with such an interface.

Therefore, it would be desirable to provide a PDA having a mechanical interface suitable for coupling the PDA to an electronic lock.

Summary of the Invention

According to the present invention, a mechanical interface for a PDA that allows the PDA to be positioned in an operative relationship relative to an electronic lock (or electronic lockbox) is provided. With the mechanical interface, the PDA can be used as a key to actuate the lock, e.g., by transmitting
signals to the lock. The signals, which may represent a code, may be transmitted from the existing PDA circuitry through a connection to circuitry in the mechanical interface, and through a link from mechanical interface to the electronic lock. The link between the mechanical interface of the PDA and the lock may be electrical contacts.

The mechanical interface may be a specially shaped retrofit back that replaces the standard back of the PDA. To configure the PDA with the retrofit back, the standard back is removed and the retrofit back is installed in its place. Circuitry in the retrofit back is electrically connected with the PDA circuitry.

According to a variation, the mechanical interface is an element that is removably coupled with the PDA, but does not require disassembling the PDA as in the case of the retrofit back. The mechanical interface according to this variation may be an element that fits against the standard back of the PDA, which may be a part of a case for housing the PDA. According to this variation, the connection between the PDA and the element can be made by a plug or port on the standard back of the PDA.

Such a case for a PDA may have a cover that overlies the screen of the device and has a device operating feature allowing the device to be operated with the cover in place. The cover may also include a window that allows at least a portion of the screen to be viewed while the cover is in place.

The mechanical interface may also be configured for coupling with a stand that is connected to an AC power source and/or a data transmission line to, e.g., recharge the PDA battery or upload/download data from a network or computer.

**Brief Description of the Drawings**

Fig. 1 shows a back of a modified PDA according to a first implementation of the present invention.

Fig. 2 shows a PDA according to the present invention in a stand or "nest".
Fig. 3 is a diagram showing a PDA and examples of its connectivity to a lockbox, its stand, a personal computer and various networks.

Fig. 4 is a perspective view of the case of a second implementation in an opened position showing the front cover coupled to the rear cover.

Fig. 5 is a side view of the case of Fig. 4 showing the coupling between the front cover and the rear cover.

Figs. 6A, 6B and 6C are front side, left side and rear side views, respectively, of the front cover of the case shown in Fig. 4.

Figs. 7A and 7B are additional perspective views of the front cover.

Figs. 8A, 8B and 8C are rear side, left side and front side views, respectively, of an outer portion of the rear cover.

Figs. 9A and 9B are additional perspective views of the outer portion of the rear cover.

Figs. 10A, 10B and 10C are front side, right side and rear side views, respectively, of an inner portion of the rear cover.

Figs. 11A and 11B are additional perspective views of the inner portion of the rear cover.

Figs. 12A, 12B and 12C are front side, right side and rear side views, respectively, of a front cover of an alternative case.

Figs. 13A and 13B are additional perspective views of the front cover of Figs. 12A, 12B and 12C.

Fig. 14 is a magnified view of a portion of Fig. 5 showing the coupling between the front cover and the rear cover in a larger scale.

Fig. 15A and 15B are exploded views of the case, together with a PDA and components of the case.

Fig. 16 is a perspective view of an optional soft front cover of the case.

Fig. 17 is a perspective view of a stand designed to receive and electrically connect with the case.
Fig. 18 is a schematic block diagram of a PDA showing the connections between its user interface, controller, memory, battery and communications interface.

**Detailed Description**

According to the invention, a mechanical interface for a PDA adapts the PDA for use as a key to an electronic lock or an electronic lockbox. The interface provides for other functionality as well, including connectivity between the PDA and networks or computers (e.g., for transmitting and/or receiving data).

In the following section, a first specific implementation and general principles are described with general reference to Figs. 1-3. In the subsequent section, a second specific implementation is described with reference to Figs. 4-17.

**FIRST SPECIFIC IMPLEMENTATION AND GENERAL PRINCIPLES**

In the illustrated embodiments, the PDA is a PalmPilot unit (e.g. the PalmPilot III, PalmPilot V, or the radio-equipped PalmPilot VII). These units feature relatively large display screens, which also serve as touch-input devices. The display screens can be programmed to present visual interfaces modeled after those of conventional keys, facilitating user training. Users respond by interacting with the screen, e.g., by pressing buttons displayed on the screen.

In a first specific implementation, the back of the PalmPilot unit is removed, and a retrofit back (a portion of which is shown in Fig. 1) is installed to serve as the mechanical interface and to provide the mechanical and electrical components needed to interface with the electronic lock.

The mechanical configuration of the replacement back portion will depend on the particular PDA being reconfigured, and the lock with which it is to be used. In the illustrated embodiment, the replacement back has an engagement portion 14 extending therefrom that is sized to be received within a physical interface on the front of the lock. Electrical terminals 60a, 60b are provided to effect transfer of data between the PDA and lock units (and optionally, to provide power from the palmtop to the lock).
Within the retrofit back are drive electronics for the lock signals, and related lock-specific circuitry. While electronic keys typically include microprocessors and associated memories, the PDA's processor and memory can be used for these purposes. Alternatively, a separate microprocessor and memory can be provided for key-specific functionality. Even in such alternative embodiments, however, the PalmPilot microprocessor can be used for control of the display and touch screen. (The design of electronic keys is known to the artisans in the field, so key-specific details are not belabored here.)

In this exemplary embodiment, the PDA is returned to a "nest" or stand 10 (Fig. 2) every evening (or other appropriate interval) to recharge its batteries. Included in the stand is a two-way link to a remote clearinghouse. This link can be effected by radio or wired connection. A wired connection may couple to the remote clearinghouse over a dedicated or dial-up direct link, or over the Internet. At a pre-programmed time each evening, the PDA exchanges data with the remote clearinghouse. The PDA functionality as a key is desirably programmed to "expire" periodically, such as every 24 hours. When the PDA communicates with the central clearinghouse, update data may be provided to the key to extend its life a further 24 hours (assuming, e.g., the PDA owner has fulfilled whatever "incentive," e.g., payment of dues or fees, etc. that was outstanding), and has not otherwise become disqualified from continued use of a key. By such arrangement, if the PDA is not periodically linked to the clearinghouse, the PDA loses its key functionality.

During the PDA's nightly exchange with the central clearinghouse, the clearinghouse downloads to the key new data relating to the lock system. In the illustrated embodiment, the lock system is a real estate lockbox system (but the present technology can equally-well be applied to other types of lock systems, e.g., industrial site security systems or unattended delivery systems). The data downloaded nightly thus includes profiles of new homes listed for sale ("new listings"). To reduce download time and memory consumption in the PDA, only data about selected new listings is downloaded. For example, a user of the PDA may define a profile identifying the types of new listings for which updates are
desired. Such data can be defined in boolean fashion, using parameters familiar to real estate agents (e.g. within specified price ranges, neighborhoods, square footages, home age, amenities, etc.). Several such profiles can be defined. Each night, these profiles are compared against new listing data at the central clearinghouse to identify the data that should be relayed to the PDA.

The process of defining the profiles can employ the PDA and its user interface, in conjunction with a server computer at the central clearinghouse. If the central clearinghouse server supports Internet access, a conventional Internet browser can also be used from a desktop computer to interactively define desired profiles for a given user.

While the above-referenced downloading typically takes place during the night, the PDA can be nested at any time, and an update can be invoked by suitable instructions to the palmtop and/or nest (e.g., by pressing a hot sync button 12 on the stand, thereby launching the update process). Alternatively, the act of nesting the PDA in the stand can initiate the updating process (i.e., with requiring a user to press the button 12).

Data in addition to new listing data can be downloaded to the PDA during the nightly sessions. For example, one or more screens of bulletins might be provided to the PDA, providing information of interest to the users. These bulletins may be displayed when the PDA is removed from the stand, or can be summoned to the display anytime during the day in response to user command.

The bulletins can include reminders of upcoming dues payments to the local realtor's association, notices of upcoming seminars of interest, daily quotations of mortgage interest rates, and other news topics of interest to real estate agents.

News of more general interest might also be included, such as current prices of favorite stocks, the day's weather report, etc.

Other bulletins may convey technical information relating to the lockbox system, such as hints for easier key usage, notices of scheduled upgrades, etc.
Other bulletins may take the form of advertising, e.g., by title insurance companies, real estate lawyers, mortgage brokers, etc.

Other bulletins may include data specific to the user, such as sales year-to-date, average time on market for user's listings, ordered lists of the homes listed for sale by the user ranked by their showing frequency (or the lastShown date), recent access information for homes listed for sale by the user (detailing, e.g., the address of the property, the listing number, the name of the showing real estate agent, the agent's telephone number, and the date/time of showing), etc.

Various software productivity tools are marketed to real estate professionals (e.g., Top Producer software and a variety of electronic mapping products). Some of these can be run on PDA. Desirably, data from the bulletins can be imported into these software tools, whether by cut/paste operations, or by more sophisticated known data exchange techniques. Such data can also be imported into standard productivity tools conventionally resident on PDA (e.g., date book, address/phone book, e-mail, financial calendar, etc.)

As described in U.S. Patent No. 5,654,696, the downloading of data to the palmtop can be withheld until the PDA has first uploaded its activity data to the central clearinghouse. Such data is necessary in order for the clearinghouse to track which keys access which locks, and when.

In some variants, the PDA is provided with an accessory (e.g., added with the retrofit back) to make electronic measurements of a room's dimensions using known techniques (e.g., based on acoustic wave techniques).

In the following paragraphs, further details of the first specific implementation are described. In this section, KIM is the name given to the central clearinghouse, and KIMnet is the name given to the private network through which the clearinghouse communicates with the stands, etc. In other embodiments, public networks can be used. AEII is the Advantage Express II electronic real estate lockbox system marketed by Interlogix, Inc., and detailed in certain of the patents cited above. AEIII is Interlogix, Inc.'s enhanced electronic real estate lockbox system.
The AEIII "PDA/keybox" key or "PDA key", e.g., the PDA used as a key, has the following functionality in addition to the current features found in the existing AEII key:

1. Fully compatible with the AEII keybox system; and
2. Designed to take advantage of the enhanced features of the next generation AEIII keybox.

The PDA key is a personal productivity tool that incorporates the following functions:

- Keybox functionality
- Access to MLS (Multiple Listing Service) data
- Business communications
- Personal productivity

Fig. 3 is a diagram showing an exemplary PDA, its use as a PDA key and the connectivity between the PDA key and other entities, such as other computers and networks. In the illustrated implementation, the PDA key 80 is fitted with the retrofit back of Fig. 1 or inserted into a case 100 (described below). As described, the retrofit back or the case has an engagement portion shaped to engage a physical interface of the electronic lock or electronic lockbox.

In the illustrated implementation of Fig. 3, an electronic lockbox 82 has a physical interface 84 shaped to receive or engage the engagement portion of the retrofit back or the case. When the PDA key is engaged with the lockbox 82, the PDA key can be used to transmit signals to the lockbox, e.g., to actuate and unlock the lockbox. Typically, as in this example, the lockbox contains a conventional key to a residence or building. In addition to accessing the lockbox, the PDA key can also transmit data to and receive data from the lockbox.

The stand 10, which is represented by the hot sync icon, is part of one link between the PDA key and a home/office PC 86 and the central clearinghouse, which is depicted at 88 in Fig. 3.

As described, the stand receives the PDA (or the PDA in its case, as described below) and forms data transfer link between the PDA and the central clearinghouse, e.g., by a dial-up modem over a local phone line 90 as shown, or
wirelessly. Similarly, the stand can be configured to have a link to the home/office PC as well. In some systems, the PDA is wirelessly linked to the home/office PC, the central clearinghouse, and, possibly, other entities as well.

The central clearinghouse, which may be one or more computers or a network, receives data from the PDA key and transmits data to the PDA key. In the illustrated example, the central clearinghouse includes a database 92, which in this case is a database containing MLS data. The central clearinghouse is typically located remote from the user's location.

As illustrated at the right side of Fig. 3, a user may also access the clearinghouse by establishing a voice connection over a telephone line, and transfer data to or from the PDA key by manual entry.

Thus, the PDA key serves as both an access device to an electronic lock (in this case, an electronic lockbox) and as a user interface to a remote database (in this case, the central clearinghouse and/or the MLS database).

Various details of the data transfer operations and other attributes of the system are described below.

*Keybox Functionality*

**Board/MLS System Features**

A real estate board (the "Board") or a MLS administrator has the option to "kill" (i.e., deactivate) keys on a daily (24-hour) basis.

The Board/MLS has the ability to communicate with all active keyholders on a daily basis using the broadcast bulletin board, as described in the Business Communications section below.

The Board/MLS has the ability to see the total showing activity on a daily basis and has password-controlled access to each keyholder's daily activity by the keybox serial number. The MLS is able to provide agents access to listing information without requiring the use of a PC, as described below in the Agent System Features section.

The Board/MLS may have a keybox that provides for a security level that is certified by an independent party (i.e., Underwriters Laboratory).
Agent System Features

1. Automated Updates

Agents are not required to physically update their key on a monthly basis. When placed on the hot sync stand 10, the PDA key will be automatically updated (provided status is "authorized") via the daily hot sync upload/download program.

The PDA key automatically notifies the agent (via a message on its own display) if the key is "expired." This notification will take place whenever the PDA key is turned on.

2. Battery Maintenance

An agent's PDA key will have a rechargeable power source that is charged whenever the agent places the PDA key on the hot sync stand.

3. Keyholder Messages

The PDA key displays user and system error messages. Examples include "incorrect PIN code," "access not granted due to time of day lockout hours violation," "incorrect shackle code," "call before showing is on," etc. Shackle codes are the codes required to activate the lockbox shackle that secures the lockbox to an object, e.g., the doorknob of a door to a residence.

The PDA key notifies agents when their listings have been shown. If an agent's listing is shown the prior day, the agent receives a "you have showings" message when the PDA key is turned on. The agent is then able to display the showings that occurred the previous day by listing address, the agent who showed property, the showing agent's phone number, and the date and time the showing occurred. This information is downloaded as part of the daily hot sync upload/download program. Showings can be displayed by listing address, provided the listing agent has input the address into the listing agent's PDA key or the MLS broker load system has entered the serial number of the keybox and an interface with KIM exists.
4. **FSK Transmissions**

The tone transmission capability for downloading keybox showing information may work with both digital and analog cellular phones, as well as the PDA key equipped with the case 100 (described below). The most recent five accesses will be downloaded. There is no need for downloading additional accesses because all agent activity is uploaded daily and then sorted by keybox serial number. Tone transmission capability is valuable when an agent must know exactly who showed a particular listing up to the current moment in time.

The agent has the ability to input all relevant keybox inventory data and programming information into the agent’s PDA key. For example:

<table>
<thead>
<tr>
<th>Keybox #</th>
<th>Listing Address</th>
<th>Shackle Code</th>
<th>Time of Day Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>7300912</td>
<td>234 Elm Street</td>
<td>4646</td>
<td>9:00 p.m. to 8:00 a.m.</td>
</tr>
<tr>
<td>5420981</td>
<td>9876 Melody Ln.</td>
<td>9870</td>
<td>24 hour access</td>
</tr>
</tbody>
</table>

The above inventory and programming information is updated each time the agent elects to use the PDA key to reprogram a keybox.

5. **New Showing Reports**

As previously described, KIM downloads new showings for the agent’s listings on a daily basis. Only the keybox serial number and date/time of showing are downloaded to the PDA key. The PDA key uses the keybox inventory file to match these showings by serial number to the keybox address contained in the PDA key. This allows the agent’s key to then display a “new showing” report on the PDA display, giving it by listing address.

6. **Custom Programming**

The agent may use the PDA key to reprogram shackle codes. The existing shackle code must be input in order to update it to a new shackle code. After an agent reprograms a keybox, the KIM database will be automatically updated with the change during the daily hot sync upload/download program.
The agent may use the PDA key to reprogram the Time-of-Day keybox access hours. The shackle code must be input in order to change the access hours. When an agent reprograms a keybox, the KIM database will be updated with those changes during the daily hot sync upload/download program.

An agent may use the PDA key to turn "on" or "off" the Call Before Showing ("CBS") function. The agent will also be able to reprogram the CBS code of a particular keybox. When an agent reprograms that keybox, the KIM database will be updated with those changes during the daily hot sync upload/download program.

7. Showing-Activity Reports

Listing agents will be able to receive showing-activity reports for their listings without reading the keybox. As part of the daily hot sync upload/download process, the showing activity from every agent’s PDA key will be sent to KIM and sorted by keybox serial number. Agents will be able to access/request showing reports of their listings in the following manner:

- Voice reports
- Internet access
- Fax reports
- MLS menu option

An agent’s individual keybox access/showing activity will also be available. The agent activity is stored as part of the daily hot sync upload/download process. The agent activity can be accessed by the agent, the agent’s broker or the Association in the following manner:

- Voice reports
- Internet access
- Fax reports

Keybox activity reports will also be available at the listing. The user will use the existing keybox read function and use the speaker in the PDA key to transmit the most recent five accesses/showings. A voice report will then
provide the names, offices, phone numbers and dates and times of access. A fax report could then be requested as well.

8. Immediate Showing Feedback

Listing agents will be able to read a keybox and immediately display the last five entries on the PDA key, including the showing agent's PDA serial number, and date and time of access. This function requires no FSK transmission and is not intended to identify the agent, but only determine if a keybox transaction took place during the timeframe than an incident occurred. If the agent name is required, the tone transmission function and the voice report option are used.

9. Infrared Capacity

The PDA/keybox key is designed with an infrared transmission capability allowing it to be used with an enhanced keybox. The enhanced keybox will have a UL listing, and will be smaller in size than the AEII keybox. Further, this keybox will allow a keybox activity report (including agent name and phone number) to be displayed on the PDA key at the listing, without transmission to the KIM system.

MLS Access Functions

Access to MLS System Information

Agents are able to automatically receive and optionally gain access to MLS information using the hot sync stand 10 and the daily upload/download program. A wireless communication protocol allows an enhanced PDA to make such communications wirelessly. MLS access can be accomplished as part of the automatic nightly download process. The agent initiates this process by placing the PDA key on the hot sync base or nest 10, or the process can be performed on demand by selecting the desired function and then placing the PDA key on the base or nest 10 and depressing the hot sync button 12. Information and functions that will be available are:
• Agents' Personal Listings

A summary of the agent's personal listings is downloaded with selected fields, such as listing address, owner name, square footage, price, bedrooms, baths, days on the market, etc. The PDA database is updated during the nightly hot sync upload/download only when there is a change to the agent's listings.

• Custom Listing/Information (Agents' Farm)

Agents may request a custom profile that will be programmed into their PDA key. This profile will determine what MLS data is downloaded into the PDA key as part of the daily hot sync upload/download process. The custom profile will contain new or changed listing information specific to pre-specified characteristics of the agent's territory or "farm." A profile sheet is filled out by the agent and entered into the PDA key during system implementation.

Examples of information contained in this profile would be listing number, listing address, price, square footage, number of bedrooms/baths, or listing information that has changed on an existing listing, assuming that the request for the information was contained in the profile selected by the agent during initial programming.

• Listing Hot Sheet

With access to MLS System Information as described above, an agent can choose to be notified of all new listings. This hot sheet feature would allow the agent to be made aware of the most recent listings rather than having new listings roll up into the custom listing information described above.

• Buyers Show

An agent may choose to initiate a search of the MLS database by selecting from a number of search fields. For instance, an agent could select a specific zone or market area, price range, square footage range, number of baths, bedrooms, etc. The agent then places the PDA key on the hot sync stand and
initiates an upload. The result of the search would then be downloaded to the PDA key for display by the agent. This function can be requested in an "off-line" mode by the agent inputting the request for information but not placing the PDA key on the base or nest 10 until a later time. In this instance, the information requested would be processed as part of the daily hot sync upload/download program.

Business Communications

1. Broker Bulletin Board

The broker has the ability to input information for display on the bulletin board of each agent's PDA key. The bulletin board can be updated at any time by the Broker via the Internet, and will be automatically downloaded to an agent's PDA key anytime the PDA key is placed on a hot sync stand 10. In addition to the Broker bulletin board, offices may also communicate with the agents assigned to that office via the PDA key using the same process.

2. Board/MLS Bulletin Board

The Board and/or the MLS will have the same capability to communicate with the member agents as described in the Broker Bulletin Board above.

3. Technical Administration Bulletin Board

The Technical Administrator of the network will have the ability to broadcast technical and user information through the network to agents' PDA keys. Examples may include helpful hints for using the system, technical support suggestions and guidelines, product promotions and listing technology trend updates.
4. **General Bulletin Board**

The Board or broker will be able to sell bulletin board space to an organization outside real estate channels. Such advertising will generate revenue for the Board or Broker and may defray the cost of the PDA key for members.

5. **New Listing Board**

The New Listing Board enables an office to communicate new listings that have occurred. This feature allows Brokers the ability to post listings to their agents before they appear in the MLS.

6. **Public Information (Programmable Profiles)**

The PDA key can also be programmed to receive daily downloads of information such as stock updates, tax schedules and updates, industry specific information, etc.

*Agent Personal Productivity Tools*

The agent will have full use of all existing PalmPilot standard application programs that are delivered with a PalmPilot V unit. These include:

- Date book (appointment scheduler that can display daily, weekly or monthly view screens and is equipped with reminder alarms)

- Address/phone book (program for filing and editing addresses and personal notes)

- Memo list (allows user to write messages that can be synchronized to computer applications, e.g., Microsoft Word)

- E-mail (receive and respond to electronic mail messages whenever the PDA key is placed onto the hot sync stand)

- Financial Calculator (calculate payment, interest and amortization)
SECOND SPECIFIC IMPLEMENTATION

In the second specific implementation, which is described in this section with reference to Figs. 4-17, the mechanical interface is part of a case for the PDA, such as the case 100.

As shown in Figs. 4 and 5, the case 100 for an electronic device D (Fig. 15B), such as a PDA, has a front cover 102 coupleable with a rear cover 104. The front cover 102 and the rear cover 104 are shaped to fit together and form a space for housing the device D when the front cover 102 and the rear cover 104 are closed. In some applications, a cover such as the front cover 102 can be used alone without the rear cover 104.

The case 100 can be sized to accommodate any particular electronic device. In the illustrated implementation, the case 100 is sized to accommodate the PalmPilot V series of personal digital assistants manufactured by 3Com Corporation. As most clearly illustrated in Fig. 5, the case 100 can be opened to insert, remove or access the device, or to otherwise access the interior of the case 100.

The case may be shaped to engage a stand, and, when engaged, may form an electrical connection with the stand such that (1) power can be received from the stand (e.g., to power and recharge the case and/or the device) and (2) data can be exchanged through the stand (e.g., to another connected device or entity).

In the illustrated implementation, the front cover 102 is pivotably connected to the rear cover 104 by a hinge 106. Details of the hinge 106 are discussed below. As illustrated, the hinge 106 is positioned adjacent a top edge of the case 100. The hinge 106 could also be positioned along any of the other edges of the case 100. The front cover 102 and the rear cover 104 can be positively latched together in the closed position by a mechanical catch or magnetic latch (not shown).

Referring to Figs. 4, 5, 6A-6C, 7A and 7B, the front cover 102 has an outer surface with a window 107, a keypad 108 with individual keys projecting through corresponding key apertures 109, and a power button 110 projecting
through a corresponding button aperture 111. The front cover 102 also has a nose-shaped front portion 118, shaped sides 116a, 116b, a relieved portion 122 (e.g., to receive an insignia), and accent grooves 124.

The window 107 is made from transparent plastic or other suitable material. The window 107 is sized and positioned to permit a user to view at least a portion of the screen (or display) of the device when the case 100 is closed with the front cover 100 in overlying relation with the screen of the device. Thus, the user can view the display of the device while the device is operated.

In the illustrated implementation, the keypad 108 and the button 110 are formed together from an elastomeric material. The keypad 108 has twelve keys arranged in a 3 X 4 matrix (including, e.g., number keys 1-0 and two other keys) and a larger key positioned centrally below the lowest row (e.g., a command key). Preferably, the keys are joined together without gaps to provide additional resistance to entry of moisture through the apertures 109 and 111. For example, the keys can be raised areas of a continuous sheet of molded flexible plastic material, with the sheet of plastic material located on the inside of the cover with the sheet covering all of the key openings.

The keys of the keypad 108 are each independently depressible into contact with a portion of the screen of the device when the front cover 102 is in overlying relation with the device. The screen of the device is programmed to be receptive to touch input. Preferably, the inputs received by the screen via the keys of the keypad 108 are shown on the portion of the screen visible through the window 107.

The button 110 of the cover 102, which is preferably joined to the keypad 108, can be depressed to operate a corresponding button D1 (e.g., a power button) of the device D (see Fig. 15B). The button 110 is positioned on the front cover 102 to be aligned with and above the button D1 when the cover 102 is in overlying relation with the device D.

As illustrated in Fig. 5, the rear cover 104 is formed of an inner rear cover portion 126 joined to an outer rear cover portion 128. As illustrated in Figs. 10A-10C, 11A and 11B, the inner rear cover portion 126 has an inner
side 127a that receives a bottom side of a device when the device is inserted into the case 100, and an opposite outer side 127b. As illustrated in Figs. 8A-8C, 9A and 9B, the outer rear cover has an outer side 129a that forms an outer surface of the rear cover 104, and an opposite inner side 129b. The inner side 129b of the outer rear cover portion 128 contacts the outer side 127b of the inner rear cover portion 126 when the outer rear cover portion 128 and the inner rear cover portion 126 are joined together.

As illustrated, the outer rear cover portion 128 has apertures 132 through which fasteners (e.g., screws) can be driven and received in corresponding bosses 133 formed in the inner side 129b of the inner rear cover portion 126. Depending upon the thickness of the material used for the inner rear cover portion 126 and the outer rear cover portion 128, threaded inserts may be used to support the fasteners.

As illustrated, the rear cover 104 has a protruding portion 112. The protruding portion 112 may be shaped for engagement with another device, and may include structure to electrically connect the case 100 with the device, e.g., to provide power to the external device or to transfer data between the external device and the case 100. As illustrated most clearly in Figs. 8C and 9D, the protruding portion 112 defines a recess 114 in the inner side 129b of the outer rear cover portion 128. Within the recess 114, there is a circular rib 130 positioned, e.g., to support electronic components. As illustrated in Figs. 8A and 9A, speaker apertures 131 are formed in the protruding portion 112 to permit communication between the case 100 and an adjacent external device as described below in more detail. As illustrated most clearly in Figs. 8A and 9B, a top surface 112a of the protruding portion 112 includes apertures 135 sized to receive contacts (such as the contacts 302 shown in Fig. 15B) for electrically connecting the case 100 to another device.

Alternatively, the case can be configured to communicate with another device by infrared communication. A device such as the PalmPilot V includes an infrared transmitter and receiver, and thus the case 100 could be provided with an aperture positioned to allow the infrared transmitter and receiver
to function while the device is in the case 100. Additionally, the case 100 itself
could be configured with an infrared transmitter or receiver (not shown). Also,
the case 100 could be configured with a bar code reader.

As illustrated, e.g., in Figs. 5, 10B and 10A, the inner rear cover
portion 126 has sides 170a, 170b that are shaped to fit together with the
sides 116a, 116b, respectively, of the front cover 102 when the front cover 102
and the rear cover 104 are in a closed position. The sides 170a, 170b each have
an enlarged holding portion 172a, 172b, respectively, that allows the user to firmly
grasp the case 100 along it sides, e.g., during the movements necessary to engage
the protrusion 112 with another component. By configuring the holding portions
172a, 172b on the inner rear cover portion 126 rather than the front cover 102,
stress is relieved from the hinge 106. In addition, the holding portions 172a, 172b
serve to keep the device within the case 100 from shifting laterally, e.g., when the
front cover 102 of the case 100 is opened.

As illustrated in Figs. 4 and 5, the rear cover 104 has a stand
engaging portion 134 that allows the case 100 to be engaged with a stand (see
Fig. 14). The stand engaging portion 134 includes a pair of slots 136a, 136b
formed in the outer rear cover portion 128 adjacent its side edges and a notch 138
positioned between the slots 136a, 136b. Each of the slots 136a, 136b on the outer
side 129a communicates with a corresponding one of a pair of U-shaped grooves
137a, 137b, respectively, that are formed in the inner side 129b of the outer rear
cover portion 128. As illustrated in Figs. 10C and 11B, the inner rear cover
portion 126 includes corresponding U-shaped grooves 139a, 139b that are aligned
with the U-shaped grooves 137a, 137b, respectively, when the inner rear cover
portion 126 and the outer rear cover portion 128 are assembled together.

As most clearly illustrated in Fig. 14, a specific implementation of
the hinge 106 includes a male hinge member 150 extending from the front cover
102 that engages within a female hinge member 152 coupled to the rear cover 104.
The male hinge member 150 and the female hinge member 152 have bores
dimensioned to receive hinge pins 154 inserted from opposite sides (Fig. 15A). As
illustrated, the female hinge member 152 also includes a projecting retainer 156
dimensioned to secure the top front corner of the device in place within the case 100.

In a specific implementation, the female hinge member 152 has a tongue portion 157 that is slidably engageable with a corresponding groove 158 formed in the outer rear cover portion 128. The arrangement of the tongue portion 157 and groove 158 permits the front cover 102 and the female hinge member 152 to be detached from the rear cover 104 (with the female hinge member 152 remaining connected to the front cover 102 by the hinge pins 154 and the male hinge member 150). Thus, substitute front cover assemblies (i.e., front covers with female hinge members secured by hinge pins) are readily interchangeable, e.g., as desired for different uses of the case 100 and the device. If necessary, flash ribs (not shown) can be added to the tongue portion 157 such that the tongue portion 157 engages the groove 158 with sufficient friction.

A suitable substitute front cover is a front cover 102' according to a second embodiment, as illustrated in Figs. 12A, 12B, 12C, 13 A and 13B. The front cover 102' is similar to the front cover 102, except that the front cover 102' has a larger window 107', which permits a user to view a substantial portion of the screen of the device, in place of the keypad 108. Similar to the cover 102, the cover 102' has the button 110 that is depressible to operate a button (e.g., a power button) on the device.

Another suitable front cover is a soft cover 200 as illustrated in Fig. 16. The soft cover 200 is made of a flexible material (e.g., leather or fabric), and is finished with stitching near its borders. An extension flap 202 connects the male hinge portion 150 to a main cover portion 204. The soft cover 200 can be substituted for the front cover 102 or the front cover 102', e.g., for aesthetic reasons or when the protection of a hard front cover is not required.

An exploded view of the case 100 and various components within the case 100, including the device D, is illustrated in Figs. 15A and 15B. As stated above, the case 100 can be configured to take advantage of the computing, display, communication and control features of the device D, which may be general in nature, and to interface with other devices for specific tasks, based on
additional supporting electronics housed within the case 100. As illustrated in Fig. 15B, the case 100 includes a connector 301 that connects to a port S of the device D when the device D is inserted in the case 100. The connection between the port S and the connector 301 allows data to be exchanged between the case 100 and the device D. Data received from the device D may be, e.g., communicated to an external device (e.g., through a specific interface or through the stand 180, which is described below). Data received by the device D may be used, and, optionally stored in a memory of the device D. The connector 301 is also capable of providing power to the device D to operate the device D or to recharge its battery.

In a specific example, the cover 100 is adapted to interface with a part of a controlled access system, e.g., a real estate lockbox, or other similar device, as a part of an electronic access control system. Such a system is disclosed, e.g., in commonly assigned U.S. Patent No. 5,475,375. In the specific example, the contacts 302 extending through the surface 112a of the protrusion permit data to be exchanged between the case 100 and a real estate lockbox designed to receive an electronic keypad. The functions of the electronic keypad are carried out by using the keypad 108 in conjunction with the device 108.

In the specific example, the components of the case 100 include a microprocessor-based circuit on a circuit board 304, a battery 306 that powers the circuit board 304, a base 308 that attaches the battery 306 to the circuit board 304, and a piezo electric unit 310 responsive to signals from the circuit that selectively vibrates to produce tones to communicate with the lockbox. Thus, the cover 100 with the device D can communicate with a lockbox using FSK communication protocols. The case 100 also includes a connector 312 that allows the case 100 (and the device D, when connected to the case 100 via the connector 300) to communicate with an external device by a wired connection and/or to receive power from an external power source.

A specific embodiment of a stand 180, which is similar to the stand 10 except that it is designed to receive and function with the case 100, is illustrated in Fig. 17. The stand 180 has a base 181 designed to rest on a flat surface, e.g., a table or a desk. The stand 180 also has a case receiving
portion 182 shaped to receive the case 100. The case receiving portion 182 includes a pair of spaced apart ribs 184. The ribs 184 are positioned to slidingly engage the slots 136a, 136b and the U-shaped grooves 139a/137a, 139b/137b of the rear cover 104 when the case 100 is engaged with the stand 180.

A connector 186 is positioned between the ribs 184. The connector 186 is designed to mate with a second connector 300 of the case 100, thereby connecting the case 100 with the stand 180. The stand 180 receives power, e.g., from an outside power source such as a household AC power outlet, via a power cord 190. The stand also includes a data line 192 (e.g., a telephone line) for communicating data to and from the stand 180. The power cord 190 and the data line 192 are each connected to the connector 186. An indicator light 188 is positioned on a front surface of the stand 180 to indicate, e.g., a current operating mode. In a specific embodiment, the indicator light 188 is configured to show a charging level of the case 100 and/or the device D within the case 100 (e.g., by changing from a red light indicating "low charge" level to a green light indicating "full charge" level as the charge level increases).

Except as otherwise noted, the front cover, the rear cover, the hinge, the retainer and other components of the case are formed of a suitable material, such as an impact resistant plastic that will withstand some shock if dropped. Alternatively, the front cover 102, the front cover 102’ or the rear cover 104 can be formed of a metal, such as aluminum, for improved aesthetics and increased durability. If necessary, seals can be used between various components to provide additional weather resistance, such as between the inner rear cover portion 126 and the outer cover portion 128.

As used herein, "PDA" is meant to refer to any portable, microprocessor-based device, including personal digital assistants, palmtop computers, notebook computers, and dedicated microprocessor-based key units, used as an access control device for electronic lock devices. A "general purpose PDA" is meant to refer to a PDA which is not dedicated to access control tasks exclusively.
As shown in Fig. 18, an exemplary PDA has a user interface 70 (e.g., a display and an input device, such as one or more buttons or keys and/or a stylus) that is connected to a controller 72 that controls the operation of the PDA. The controller is also connected to (1) a memory 74 that stores programs and data, (2) a communications interface 78 that allows the PDA to exchange data with other devices and entities, and (3) a battery 80 that powers the PDA. The communications interface may include one or more I/O ports for exchanging data by a wired connection (and for coupling the PDA to the case 100 as described above) and an IR transmission device for making infrared communications.

Having described an illustrated the principles of our invention with reference to an illustrative embodiment, it will be recognized that the invention can be modified in arrangement and detail without departing from such principles. Accordingly, we claim as our invention all such modifications as fall within the scope and spirit of the following claims, and equivalents thereto.
WE CLAIM:

1. In a key for an electronic lock, the lock having a physical interface with which the key is designed to mechanically interact, an improvement wherein the key is a general purpose personal digital assistant (PDA) that has been modified to provide a corresponding physical interface for interacting with the physical interface of the lock, the PDA device being adapted to provide unlocking signals to the lock, wherein the functionality of an electronic key is provided with that of a personal digital assistant device.

2. The key of claim 1, wherein the corresponding interface is a retrofit back that replaces a standard back of the PDA, the retrofit back having an engagement portion shaped to engage the physical interface of the lock.

3. The key of claim 2, wherein the engagement portion has at least one electrical contact that is coupleable with a corresponding electrical contact on a lock when the PDA with the retrofit back is engaged with the physical interface of the lock.

4. The key of claim 1, wherein the corresponding interface is an element that is attached to a standard back of the PDA, the element having an engagement portion shaped to engage the physical interface of the lock.

5. The key of claim 4, wherein the element attached to the standard back is part of a case for the PDA and within which the PDA can be received.

6. The key of claim 4, wherein the engagement portion has at least one electrical contact that is coupleable with a corresponding electrical contact on the lock when the case is engaged with the physical interface of the lock.

7. In a method of operating an electronic lockbox system, the system including a central clearinghouse, an electronic lockbox mounted on a house
and containing a key thereto, and an electronic key, the central clearinghouse
including a database of information related to houses having lockboxes associated
therewith, the electronic lockbox comprising an electromechanical lock device, the
electronic key including a user interface and a memory, the method including using
the electronic key to access the electronic lockbox and store data related to said
access in the electronic key memory, an improvement comprising establishing a
communications link between the electronic key and the central clearinghouse, and
using the user interface on the electronic key as an interface to said database of
information maintained at the central clearinghouse, wherein the electronic key
serves both as an access device to an electromechanical locking device, and as a user
interface to a remote database.

8. A cover for an electronic device having a screen, the cover
comprising a window and at least one device operating feature, the cover being
coupleable with the electronic device such that the window of the cover overlies at
least a portion of the screen of the electronic device, wherein the electronic device
is operable with the device operating feature of the cover.

9. The cover of claim 8, wherein the device operating feature is
at least one button and the electronic device has at least one command receptive
portion that allows a user to operate the electronic device, and wherein when the
cover is coupled to the electronic device, the button is positioned adjacent the
command receptive portion of the electronic device such that the button of the
cover can be depressed into contact with the command receptive portion of the
electronic device.

10. The cover of claim 9, wherein the command receptive
portion of the electronic device is a touch-sensitive portion of the screen, and
wherein the button is positioned to overlie the touch-sensitive portion of the screen
when the cover is coupled to the electronic device, and wherein when the user
depresses the button, the button contacts the touch-sensitive portion of the screen.
11. The cover of claim 9, wherein the command receptive portion of the electronic device is a key, and wherein the button of the cover is positioned to overlie the key of the electronic device when the cover is coupled to the electronic device, and wherein when the user depresses the button, the button contacts the key.

12. The cover of claim 8, wherein the device operating feature is an aperture in the cover sized to receive a command actuator and the electronic device has at least one command receptive portion that allows a user to operate the electronic device, and wherein when the cover is coupled to the electronic device, the aperture is positioned adjacent the command receptive portion of the electronic device such that the command actuator can be inserted through the aperture to actuate the command receptive portion of the electronic device.

13. The cover of claim 9, wherein the cover has a keypad with a plurality of independently depressible keys, and wherein the button is one of the keys.

14. The cover of claim 8, wherein the device operating feature includes a first button and a second button, and the electronic device includes a respective first and second command receptive features that allow a user to operate the electronic device, wherein the first command receptive feature is a touch sensitive portion of the screen and the second command receptive feature is a key, and wherein when the cover is coupled to the electronic device, the first button is positioned to overlie the touch-sensitive portion of the screen and the second button is positioned to overlie the key.

15. A case for an electronic device having a front side with a touch-sensitive screen and a rear side opposite the front side, the case comprising:
a front cover with a window and at least one screen access feature;

and

a rear cover coupled to the front cover portion,

wherein when the electronic device is housed within the case, the front cover of the case of is adjacent the front side of the electronic device with at least a portion of the screen being visible through the window of the front cover, and the rear cover is adjacent the rear side of the electronic device, and wherein at least a portion of the touch-sensitive screen of the electronic device remains accessible through the front cover with the screen access feature.

16. The case of claim 15, wherein the front cover is connected to the rear cover by a hinge.

17. The case of claim 16, wherein the hinge includes a female hinge portion removably coupled to the rear cover, a male hinge portion attached to the front cover, and a hinge pin securing the male hinge portion and the female hinge portion together.

18. The case of claim 17, wherein the rear cover includes a groove for slidably receiving the female hinge portion.

19. The case of claim 15, wherein the front cover is a first front cover, further comprising a second front cover interchangeable with the first front cover.

20. A weather resistant case for a personal digital assistant (PDA) having a screen, comprising:

a front cover with a window;

a rear cover hingedly connected to the front cover,
wherein when the cover is closed with the PDA inserted therein, at least a portion of the screen of the PDA remains visible through the window of the front cover and the PDA remains operational.

21. The case of claim 20, wherein the case is electrically connected to the PDA.

22. The case of claim 20, further comprising a connector, the connector being connectable to an outside power source such that power is supplied from the outside power source through the connector to the case.

23. The case of claim 20, wherein the rear cover includes a lockbox access portion engageable with a lockbox and circuitry that exchanges signals with the lock box, the circuitry being connected to the PDA received in the case such that lockbox operations can be performed by operating the PDA through the front cover.

24. A personal digital assistant (PDA) protective case and stand system, comprising:

   a case for a PDA, the case having power receiving and power supplying connections, the power supplying connection being electrically connectable with a PDA received in the case; and

   a stand that is electrically connectable to a power source, the stand having a case receiving portion shaped to receive the case and a power supplying connection connectable with the power receiving connection of the case, the power supplying connection being capable of supplying power from the power source,

   wherein when the PDA is received within the case and electrically connected to the power supplying connection of the case, and the case is engaged within the case receiving portion of the stand with the power receiving connection of the case electrically connected to the power supplying connection of the stand, power is supplied from the stand to the case and from the case to the PDA.
25. The system of claim 24, wherein the case and the PDA each have a rechargeable power storage device, and wherein each power storage device is rechargeable with the power supplied from the stand to the case and from the case to the PDA, respectively.

26. The system of claim 24, wherein the case includes:

a PDA data connection and a stand data connection, the PDA data connection being linkable to a PDA received in the case to transfer data between the case and the PDA,

wherein the stand includes a first data connection connectable to the stand data connection of the case to transfer data between the stand and the PDA, and a second data connection to transfer data between the stand and an outside data source and receiver, and

wherein, when the case with the PDA received therein is engaged with the stand, data can be transferred between the stand, the case and the PDA.

27. A case for a personal digital assistant (PDA), the PDA having a screen with a touch-sensitive portion, at least one button for operating the PDA, and a port for exchanging data by connection to another device, the case comprising:

a front cover with a window and a keypad;

a rear cover hingedly connected to the front cover;

a first connector positioned within the case to connect with the port of the PDA and an interconnected second connector positioned on an exterior of the case for exchanging data between the PDA and an external device;

wherein when the PDA is housed within the case, the keypad is aligned opposite the touch-sensitive portion of the screen and the at least one button, and at least a portion of the screen is visible through the window of the case, such that the PDA is operable by depressing a portion of the keypad into contact with the touch sensitive portion of the screen or the at least one button.
FIG. 3
Private & secure dial up network

KIMNet
MLS Data

KeyBox
Key

Local Phone

Home/Office PC
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G06K 5/00
US CL : 340/825.31
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)

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)
EAST
Search terms: palm, palmtop, hand, handheld, computer, case, cover, hinge

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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X Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  *A* document defining the general state of the art which is not considered to be of particular relevance
  *E* earlier document published on or after the international filing date
  *L* document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  *O* document referring to an oral disclosure, use, exhibition or other means
  *P* document published prior to the international filing date but later than the priority date claimed

Date of the actual completion of the international search
02 OCTOBER 2000

Date of mailing of the international search report
27 OCT 2000

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