(54) Title: METHOD AND APPARATUS FOR AUTOMATIC TRANSFER OF CONTROL FROM AN INTERNAL PROCESSOR TO AN EXTERNAL COMPUTER

(57) Abstract

A method and apparatus for automatically transferring control of a portable radio communication device (101) having an internal processor (108) and a first data port (118) comprise transferring (412, 414) control from the internal processor (108) to an external computer (103), the external computer (103) having a second data port (128). In the portable radio communication device (101) the internal processor (108) detects (406) a signal at the first data port (118), the signal indicating that the external computer (103) is coupled to the portable radio communication device (101) through the first and second data ports (118, 128). In response, the internal processor (108) transfers (412, 414) control of the portable radio communication device (101) from the internal processor (108) to the external computer (103).
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METHOD AND APPARATUS FOR AUTOMATIC TRANSFER
OF CONTROL FROM AN INTERNAL PROCESSOR TO
AN EXTERNAL COMPUTER

Field of the Invention

This invention relates in general to portable radio communication devices, and more specifically to a method and apparatus for transferring control of such devices from an internal processor to an external computer.

Background of the Invention

Portable radio communication devices having data ports for coupling with external computers are well-known in the art. An example is the NewsStream™ Advanced Information Receiver manufactured by Motorola, Inc. of Schaumburg, IL. Some laptop computers are now being built with a standard interconnection interface for coupling with other devices, e.g., the Personal Computer Memory Card International Association (PCMCIA) interface.

A problem with this new technology is that the technology is evolving rapidly, thus causing rapid obsolescence of a portable radio communication device designed with a fixed set of features. Shortly after the portable radio communication device is manufactured, additional desirable features and options usually are developed. Unfortunately, there currently is no way to add the new features and options to portable radio communication devices in the field except to physically replace software storage elements with storage elements containing upgraded software. This procedure is relatively costly for material and labor.

An additional problem is that as new features and custom, application-specific software is developed, the size of the software may exceed a limit that is practical for a portable radio communication device in which battery life is an important consideration.
Thus, what is needed is a way of adding new features and options to a portable radio communication device without having to physically replace software storage elements. Also a way is needed of adding new features and custom application software that will not severely degrade the battery life of the portable radio communication device.

Summary of the Invention

One aspect of the present invention is a method for automatically transferring control of a portable radio communication device having an internal processor and a first data port. Control is transferred from the internal processor to an external computer, the external computer having a second data port. The method comprises in the portable radio communication device the steps of:

(a) detecting a signal at the first data port, the signal indicating that the external computer is coupled to the portable radio communication device through the first and second data ports; and

(b) transferring control of the portable radio communication device from the internal processor to the external computer in response to step (a).

Another aspect of the present invention comprises a portable radio communication device including an antenna for intercepting radio signals comprising address and message information and a receiver coupled to the antenna for demodulating the intercepted radio signals. The portable radio communication device further comprises a decoder coupled to the receiver for decoding demodulated addresses, a processor coupled to the receiver and to the decoder for controlling the portable radio communication device, and a memory coupled to the processor for storing software operating instructions and demodulated messages. The portable radio communication device also includes a data port coupled to the processor for communicating with an external computer, and a first processor element coupled to the processor for detecting a signal at the data port, the
signal indicating that the external computer is coupled to the portable radio communication device. The portable radio communication device further comprises a second processor element coupled to the processor for transferring control of the portable radio communication device from the processor to the external computer.

**Brief Description of the Drawings**

FIG. 1 is an electrical block diagram of a selective call receiver coupled to an external computer in accordance with the preferred embodiment of the present invention.

FIG. 2 is an isometric view of the selective call receiver in accordance with the preferred embodiment of the present invention.

FIG. 3 is an orthographic view of the selective call receiver coupled to the external computer in accordance with the preferred embodiment of the present invention.

FIG. 4 is a flow chart of the operation of transfer of control from a processor internal to the selective call receiver to the external computer in accordance with the preferred embodiment of the present invention.

**Description of the Preferred Embodiment**

With reference to FIG. 1, an electrical block diagram of a selective call receiver 101 is shown coupled to an external computer 103 in accordance with the preferred embodiment of the present invention and comprises an antenna 102 for intercepting RF signals. The antenna 102 is coupled to a receiver 104 for receiving and demodulating the RF signals intercepted. A decoder 106 is coupled to the receiver 104 for decoding demodulated address information. A microprocessor 108, e.g., the 68HC05C8 or C11 manufactured by Motorola, Inc. of Schaumburg, IL, is also coupled to the receiver 104 for processing the demodulated information to recover messages. The microprocessor 108 is coupled to a random access memory (RAM) 110 for storing the messages recovered, and the microprocessor 108 controls the storing
and recalling of the messages. An alert generator 112 is
coupled to the microprocessor 108 for providing an audible
or tactile alert to a user when the microprocessor 108 has a
message ready for presentation.

An output device 114 comprises a visual display or a
speaker or both, the output device 114 also being controlled
by the microprocessor 108. The control section 116
comprises user accessible controls for allowing the user to
command the microprocessor 108 to perform the selective call
receiver operations well known to one of ordinary skill in
the art and typically includes control switches such as an
on/off control button, a function control, etc.

The microprocessor 108 is coupled to a read-only memory
(ROM) 121 and a data interface 118 for controlling and
communicating with the ROM 121 and the data interface 118,
in accordance with the present invention. The ROM 121
comprises two special-purpose elements in accordance with
the present invention. An external computer detect element
140 comprises firmware for detecting the presence of an
external computer in response to a signal received by the
data interface 118. A control transfer element 142 includes
a transfer request element 144 containing firmware for
requesting transfer of control of the selective call
receiver to the external computer. The control transfer
element 142 also includes a transfer completion element 146
comprising firmware for transferring to the external
computer 103 control of functional elements listed in a
response from the external computer 103.

The data interface 118 is constructed and controlled in
a manner that meets the well-known Personal Computer Memory
Card International Association (PCMCIA) standard interface.
The data interface 118 couples with the external computer
103 by a PCMCIA bus 119. One of ordinary skill in the art
will recognize that other types of parallel interfaces could
be used as well.

The external computer 103, e.g., the HP95LX computer
manufactured by Hewlett Packard, Inc. of Palo Alto, CA,
comprises a data interface 128 also of the PCMCIA type
coupled to a microprocessor 120 for communicating with the PCMCIA bus 119. The microprocessor 120 is coupled to a display 122, typically an LCD type, and a keyboard 124 for interfacing with a user. A read-only memory (ROM) 126 is coupled to and controlled by the microprocessor 120 for storing software instructions and other pre-programmed information used by the external computer 103. A random access memory (RAM) 130 is also coupled to the microprocessor 120 for storing software programs and other values received from the microprocessor 120. The RAM 130 has been programmed with transfer of control software 132 comprising functional element identifiers 134 identifying functional elements, e.g., address decoding or message handling, that the transfer of control software 132 is able to perform.

With reference to FIG. 2, an isometric view of the selective call receiver 101 in accordance with the preferred embodiment of the present invention depicts a connector comprising the PCMCIA bus 119 for interconnecting with the external computer 103 (FIG. 1). Also depicted is a control button of the control section 116.

With reference to FIG. 3, an orthographic view of the selective call receiver 101 coupled to the external computer 103 in accordance with the preferred embodiment of the present invention depicts the selective call receiver 101 fully inserted into a PCMCIA receptacle 304 of the external computer 103. In this position, the electrical coupling provided by the PCMCIA bus 119 (FIG. 1) allows the external computer 103 to assume some or all the control of the selective call receiver 101 in accordance with the present invention.

With reference to FIG. 4, a flow chart depicts the operation of transfer of control from a processor internal to the selective call receiver 101 (FIG. 1) to the external computer 103 (FIG. 1) in accordance with the preferred embodiment of the present invention. The process begins with the external computer 103 being programmed 402 with software compatible with the transfer of control in
accordance with the preferred embodiment of the present invention. A portion of the software includes the functional element identifiers 134 (FIG. 1) that will identify to the microprocessor 108 (FIG. 1) of the selective call receiver 101 those functional elements of the selective call receiver 101 that the software can perform.

Next, the respective data interfaces 118, 128 of the selective call receiver 101 (FIG. 1) and the external computer 103 (FIG. 1) are coupled 404 together. The selective call receiver 101 senses 406 the coupling from a signal, e.g., a voltage level, supplied to the PCMCIA bus 119 (FIG. 1) by the external computer 103 and in response queues a transfer request message to be sent over the PCMCIA bus 119. The microprocessor 120 (FIG. 1) of the external computer waits 408 for the transfer request message, after which the microprocessor 120 sends 410 a list of the functional element identifiers 134 identifying the functional elements of control that the external computer 103 has been programmed to assume from the selective call receiver 101. After receiving the list sent in step 410 the selective call receiver 101 terminates 412 control of the listed functional elements, and the external computer 103 assumes 414 control of the listed functional elements through the PCMCIA bus 119. The process ends thereafter in step 416.

For the case in which one of the functional elements to be transferred to the external computer 103 (FIG. 1) is the processing of certain types of message, e.g., information service or mail drop messages, then message processing will be either transferred or not transferred, based upon message type. For example, a perfectly valid scenario would be to set up the transfer of functional elements such that individual personal messages are processed by the microprocessor 108 of the selective call receiver 101 (FIG. 1), while the typically much longer information service or mail drop messages are processed by the external computer 103.
Thus, the present invention advantageously provides a method and apparatus for adding new features and options to a portable radio communication device without having to physically replace software storage elements of the portable radio communication device. This ability reduces the cost of both material and labor for field upgrades of software. Also a way is provided for adding new features and custom application software that will not severely degrade the battery life of the portable radio communication device.

This is so because the present invention allows all software requiring either large amounts of storage or high speed memory to be executed external to the portable radio communication device, thus advantageously removing items associated with high power drain and hence conserving the battery of the portable radio communication device.

What is claimed is:
1. A method for automatically transferring control of a portable radio communication device having an internal processor and a first data port, control being transferred from the internal processor to an external computer, the external computer having a second data port, the method comprising in the portable radio communication device the steps of:

(a) detecting a signal at the first data port, the signal indicating that the external computer is coupled to the portable radio communication device through the first and second data ports; and

(b) transferring control of the portable radio communication device from the internal processor to the external computer in response to step (a).

2. The method in accordance with claim 1, wherein step (b) comprises transferring total control of the portable radio communication device from the internal processor to the external computer.

3. The method in accordance with claim 1, wherein step (b) comprises transferring partial control of the portable radio communication device from the internal processor to the external computer.

4. The method in accordance with claim 1, wherein step (b) comprises:

in the portable radio communication device the steps of:

(c) sending a signal to the external computer comprising a request for transfer of control from the internal processor to the external computer;

(d) receiving a response from the external computer comprising a list of functional elements that the external computer is programmed to control; and
(e) transferring control of the functional elements listed in step (d); and
in the external computer the steps of:
(f) responding to step (c) with the list of
functional elements that the external computer is programmed
to control; and
(g) assuming control of the functional elements listed in step (f).

5. The method in accordance with claim 1, further
comprising in the external computer the steps of:
(h) receiving software compatible with the method
for automatically transferring control; and
(i) storing the software received in step (h) in
the external computer.

6. The method in accordance with claim 1, further
comprising in the portable radio communication device the
step of:
j) programming the internal processor with
software compatible with the method for automatically
transferring control.

7. The method in accordance with claim 1, wherein step
(b) comprises the step of:
k) transferring radio communication message
decoding from the internal processor to the external
computer.

8. The method in accordance with claim 7, wherein step
(k) comprises the step of:
l) transferring radio communication message
decoding for selected messages.

9. The method in accordance with claim 8, wherein
message selection is based upon message type.
10. A portable radio communication device comprising:
   antenna means for intercepting radio signals
   comprising address and message information;
   receiver means coupled to the antenna means for
demodulating the intercepted radio signals;
   decoder means coupled to the receiver means for
decoding demodulated addresses;
   processor means coupled to the receiver means and
to the decoder means for controlling the portable radio
10 communication device;
   memory means coupled to the processor means for
storing software operating instructions and demodulated
   data port means coupled to the processor means for
15 communicating with an external computer;
   a first processor element coupled to the processor
   means for detecting a signal at the data port means, the
   signal indicating that the external computer is coupled to
   the portable radio communication device; and
   a second processor element coupled to the
20 processor means for transferring control of the portable
radio communication device from the processor means to the
   external computer.

11. The portable radio communication device of claim 10,
   wherein the data port means is constructed and operated in
   accordance with the Personal Computer Memory Card
   International Association (PCMCIA) standard.

12. The portable radio communication device of claim 10,
   wherein the second processor element comprises software
   instructions for transferring total control of the portable
   radio communication device from the processor means to the
   external computer.

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13. The portable radio communication device of claim 10, wherein the second processor element comprises software instructions for transferring partial control of the portable radio communication device from the processor means to the external computer.

14. The portable radio communication device of claim 10, wherein the second processor element comprises:
   a transfer request element for requesting a transfer of control from the internal processor to the external computer; and
   a transfer completion element coupled to the transfer request element for transferring control of functional elements listed in a response from the external computer.

15. A selective call receiver comprising:
   an antenna for intercepting radio signals comprising address and message information;
   a receiver coupled to the antenna for demodulating the intercepted radio signals;
   a decoder coupled to the receiver for decoding demodulated addresses;
   a processor coupled to the receiver and to the decoder for controlling the selective call receiver;
   a memory coupled to the processor for storing software operating instructions and demodulated messages;
   a data port coupled to the processor for communicating with an external computer;
   a first processor element coupled to the processor for detecting a signal at the data port, the signal indicating that the external computer is coupled to the selective call receiver; and
   a second processor element coupled to the processor for transferring control of the selective call receiver from the processor to the external computer.
16. The selective call receiver of claim 15, wherein the data port is constructed and operated in accordance with the Personal Computer Memory Card International Association (PCMCIA) standard.

17. The selective call receiver of claim 15, wherein the second processor element comprises software instructions for transferring total control of the selective call receiver from the processor to the external computer.

18. The selective call receiver of claim 15, wherein the second processor element comprises software instructions for transferring partial control of the selective call receiver from the processor to the external computer.

19. The selective call receiver of claim 15, wherein the second processor element comprises:

   a transfer request element for requesting a transfer of control from the internal processor to the external computer; and

   a transfer completion element coupled to the transfer request element for transferring control of functional elements listed in a response from the external computer.
FIG. 1
EXTERNAL COMPUTER (EC) IS PROGRAMMED WITH SOFTWARE FOR ASSUMING SELECTED FUNCTIONS FROM SELECTIVE CALL RECEIVER (SCR)

SCR AND XC ARE COUPLED THROUGH DATA PORTS

SCR SENSES COUPLING AND QUEUES TRANSFER REQUEST MESSAGE

HAS SCR SENT MESSAGE?

YES

XC SENDS LIST OF SELECTED FUNCTIONAL ELEMENTS TO SCR

SCR TERMINATES CONTROL OF THE LISTED FUNCTIONAL ELEMENTS

XC ASSUMES CONTROL OF THE LISTED FUNCTIONAL ELEMENTS

END

FIG. 4
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC(S): H04B 1/16
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 practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C. See patent family annex.

Date of the actual completion of the international search: 30 November 1993
Date of mailing of the international search report: FEB 16 1994

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. NOT APPLICABLE

Authorized officer: CHI PHAM
Telephone No. (703) 305-4700
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER:
US CL:
455/ 89, 186.1
340/825.44

B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.
455/ 66, 88, 89, 185.1, 186.1, 186.2;
340/825.44, 311.1