COMMUNICATION CARD WITH STANDALONE AND MASTER OPERATIONAL STATES

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ABSTRACT
A communication card with three operational states, including a controller, a battery, a flash storage unit, a wireless modem, and a connector for connecting the communication card to a shell host and to an electronic device host, wherein the communication card (i) operates in a standalone mode when the connector is not connected to a device, (ii) functions as a master when the connector is connected to the shell host, and (iii) functions as a slave when the connector is connected to the electronic device host. A method and a computer-readable storage medium are also described and claimed.
DETECTION OF COMMUNICATION CARD OPERATIONAL ENVIRONMENT

SAMPLE VBAT_HOST

DOES VBAT_HOST HAVE A VOLTAGE HIGHER THAN LOGICAL ZERO?

COMMUNICATION CARD IS NOT PLUGGED INTO A DEVICE

SAMPLE HOST_INT/TYPE

DOES HOST_INT/TYPE HAVE A VOLTAGE HIGHER THAN LOGICAL ZERO?

COMMUNICATION CARD IS PLUGGED INTO A CE DEVICE

COMMUNICATION CARD IS PLUGGED INTO A SHELL

DISABLE COMMUNICATION CARD USER INTERFACE

FIG. 2
COMMUNICATION CARD WITH
STANDALONE AND MASTER OPERATIONAL
STATES

PRIORITY REFERENCE TO RELATED
APPLICATIONS

[0001] This application claims benefit of U.S. Provisional
Application No. 60/933,793, entitled COMMUNICATION
CARD WITH THREE OPERATIONAL STATES, filed on
Jun. 8, 2007 by inventors Itay Sherman, Itay Cohen and Yaron
Segalov.

FIELD OF THE INVENTION

[0002] The present invention relates to communication
cards that may be connected to electronic devices and to
shells, and that may also operate in a standalone mode.

BACKGROUND OF THE INVENTION

[0003] Prior art communication cards include cards with
connectors that enable them to interface with different types
of electronic devices that serve as hosts. These cards
generally include a radio modem, a CPU with ancillary memories,
a power source and possibly data storage.

SUMMARY OF THE DESCRIPTION

[0004] The present invention provides a novel communica-
tion card (i) that may operate in a standalone mode, (ii) that
may be connected to a shell that is not an independent device
and that cannot operate without the communication card
being connected thereto, and (iii) that may be connected to an
electronic device that serves as the card’s host. In state (ii) the
communication card functions as a master, and in state (iii)
the communication card functions as a slave.

[0005] There is thus provided in accordance with an
embodiment of the present invention a communication card
with three operational states, namely, (i) the communication card
in a standalone mode (State I), (ii) the communication card
connected to a shell (State II), and (iii) the communication card
connected to a host (State III), monitoring a first signal on the
communication card, and if the first signal has a voltage level
lower than a designated threshold, then concluding that
the communication card is in State I, otherwise, concluding
that the communication card is in State II, otherwise, concluding that the
communication card is in State III.

[0007] There is moreover provided in accordance with an
embodiment of the present invention a computer readable
storage medium storing program code for causing a comput-
ing device to determine the state of a communication card that
has three operational states, namely, (i) the communication card in a standalone mode (State I), (ii) the communication card
connected to a shell (State II), and (iii) the communication card
connected to a host (State III), by monitoring a first signal on the communication card, and if the first signal has a
voltage level lower than a designated threshold, then concluding
that the communication card is in State I, otherwise, concluding
that the communication card is in State II, otherwise, concluding that the
communication card is in State III.

[0008] There is further provided in accordance with an
embodiment of the present invention a communication card
with three operational states, including a card connector for
connecting a communication card to a shell and to an elec-
tronic device, including a connector for connecting and out-
going audio signals, a connector for a power supply, a universal
serial bus (USB) connector, and a communication bus,
wherein (i) no signals are routed to the communication bus
when the card operates in a standalone mode (State I), (ii)
secure digital (SD) card signals and secure digital (SD) card signals are routed to the communication
bus when the card is connected to a shell (State II), with
the card functioning as master, and (iii) SD card signals are
routed to the communication bus when the card is connected
to an electronic device (State III), with the card functioning as
slave, and circuitry for automatically detecting the device
whether the card is operating in State I, State II or State III.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will be more fully understood
and appreciated from the following detailed description,
taken in conjunction with the drawings in which:

[0010] FIG. 1 is a simplified block diagram of a communica-
tion card with three operational states, in accordance with a
first embodiment of the present invention; and

[0011] FIG. 2 is a simplified flowchart of a method for a
communication card to detect the type of device it is con-
ected to, in accordance with an embodiment of the present
invention.

DETAILED DESCRIPTION

[0012] The present invention relates to a communication
card that is operable in three states; namely, (I) a standalone
state, (II) a state connected to a simple host, and (III) a state
connected to a complex host. In State I the simple host is
a shell. The communication card operates as a master and the
shell operates as a slave. Conversely, in State III the complex
host is a consumer electronics (CE) device. The communication
card operates as a slave and the CE device operates as a
master.

[0013] In State I as a standalone, the card has its own user
interface and provides communication data and voice over
radio technology, in addition to other services including inter alia MP3 playing.

[0014] In State II connected to a simple host, the shell is not
an independent device and cannot operate without the commu-
nication card being connected thereto. The shell may
include only a display, a keyboard and a simple non-volatile
EEPROM storage chip. Optionally, the shell may further
include speakers, a microphone and a secondary power source. The communication card supplies power to the shell’s keyboard, display speakers and microphone, and to the card’s own internal circuitry. The communication card uses the shell’s secondary power source to charge the card’s internal power source.

During initialization, after the communication card is attached to the shell, or at boot time, static configuration parameters are read from the EEPROM of the shell to the communication card. Thereafter, the communication card provides the shell with display information, in the form of screen shots such as bitmap images.

In State III connected to a complex host, the CE device is an independent device that operates independently of the communication card, such as an MP3/MPP player or a digital camera. Commands and information are shared, and sent over an SD control bus during operation. The CE device includes its own CPU, user interface and power source. The user interface for both the device functionality and the communication card functionality operates through the CE device. The interface to the CE device is via the communication card connector, where pins on the connector have specifically assigned functionalities and use specific protocols.

It will thus be appreciated by those skilled in the art that the interface to the shell is via the same communication card connector as is the interface to the CE device, but the pins on the connector generally have different functionalities and use different protocols with the shell than those used with the CE device.

The three operational states of the communication card are summarized in Table I hereinbelow.

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Standalone</td>
<td>Card uses its own interface</td>
</tr>
<tr>
<td>II</td>
<td>Connected to a simple host</td>
<td>Card in master; Shell in slave</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shell cannot operate without card</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Card provides shell with screen shots, in the form of bitmap images, for display information</td>
</tr>
<tr>
<td>III</td>
<td>Connected to a complex host</td>
<td>CE device operates independently of card</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Card provides shell with screen shots, in the form of bitmap images, for display information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication is through SD bus</td>
</tr>
</tbody>
</table>

Reference is now made to FIG. 1, which is a simplified block diagram of a communication card with three operational states, in accordance with a first embodiment of the present invention. As shown in FIG. 1, a communication card 100 includes a connector 105, a controller 110, a flash storage unit 115, a battery subsystem 120, a USB connector 125 and a modem & applications processor 130. modem 130 includes a radio frequency (RF) interface 135 and an audio player 140. Wireless modem is coupled with an input device 145, which is a small keyboard, and an output device 150, which is a small display.

Also shown in FIG. 1 is a host device 160 with a host connector 165 that may be connected to the communication card connector 105. In accordance with an embodiment of the present invention, device 160 may be a shell and may be a CE device.

It will be appreciated by those skilled in the art that communication card 100 supports the three operational states in TABLE 1. Components 105-150 enable communication card 100 to function as a standalone device. When host 160 is connected to communication card 100, communication card 100 may operate as a master or as a slave, and the SD communication between connectors 105 and 165 flows accordingly. Specifically, in State II communication card 100 is the master and host 160 is the slave, and in State III communication card 100 is the slave and host 160 is the master.

In accordance with an embodiment of the present invention communication card 100 automatically detects its operational environment by monitoring the voltage on designated pins on the communication card. i.e., communication card 100 distinguishes between States I-III based on voltage. CE devices and shells generally drive the voltage on these pins differently, which enables communication card 100 to discriminate whether or not it is connected to device 160, and to detect the type of device 160 it is connected to.

In this regard, reference is made to FIG. 2, which is a simplified block diagram of a method for communication card 100 to detect the type of host 160 it is connected to, in accordance with an embodiment of the present invention. At step 210 controller 105 monitors the host signal VBat_host, shown in FIG. 1. If the VBat_host signal has a voltage level higher than logical zero (i.e., 0.5V or higher), as determined at step 220, then controller 105 concludes that communication card 100 is connected to host 160. Otherwise, if VBat_host is logical zero (i.e., below 0.5V), then at step 230 controller 105 concludes that communication card 100 is not connected to a host. As such, it will be appreciated by those skilled in the art that when host 160 is attached to communication card 100, controller 105 detects this by monitoring VBat_host.

In order to detect which type of host 160 is connected to communication card 100, controller 105 monitors the HOST_INT/TYPE signal, shown in FIG. 1. When connection to a host is detected, the HOST_INT/TYPE signal is sampled at step 240. If HOST_INT/TYPE is a logical zero (i.e., below 0.5V), as determined at step 250, then at step 260 the controller concludes that host 160 is a simple shell. Otherwise, if HOST_INT/TYPE is higher than logical zero (i.e., 0.5V or higher), then at step 270 the controller concludes that host 160 is a CE device.

The functionality of HOST_INT/TYPE for detecting the type of host 160, is used when at the time host 160 is attached to communication card 100. Afterwards, the signal HOST_INT/TYPE is used as an interrupt signal.

In an alternative embodiment of the present invention, the SD_Vdd signal, shown in FIG. 1, may be monitored at step 210 instead of or in addition to the VBat_host signal. Whereas the VBa_host signal generally indicates whether or not communication card 100 is connected to host 160, the SD_Vdd signal generally indicates whether or not host 160 is turned on.

It will be appreciated by those skilled in the art that the threshold of 0.5V used in the above discussion is merely indicative of a general pre-designated threshold that is used to detect attached of the host to the communication card, and to detect the type of host.

When communication card controller 105 detects connection to a CE device or a shell, the internal user interface of communication card 100 is disabled at step 280. For CE devices, communication card controller 105 receives user interface inputs, and provides feedback as bitmap graphics BMP screen shots, or as single messages, via the secure digital (SD) card bus. The CE device controls the device's
display and keyboard. For shell devices, the communication card controller receives direct keyboard strokes on the shell keyboard over an SD bus, and provides the displayed image pixels/characters directly to the shell display over the SD bus.

[0029] In an embodiment of the present invention, in order to be powered, shells connect their internal circuitry to the Vbat_CC signal that connects to connector 105. If a shell 160 has a secondary battery, then the secondary battery is connected to Vbat_Host, which connects to communication card's battery subsystem 120 and is used to charge the communication card's internal battery.

[0030] Similarly, the internal circuitry of a CE device 160 is powered by connecting its internal power source to Vbat_Host. CE device 160 does not use the Vbat_CC signal as a power source, but may monitor it to detect when communication card 100 is connected thereto, or to monitor the communication card's battery level.

[0031] In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made to the specific exemplary embodiments without departing from the broader spirit and scope of the invention as set forth in the appended claims. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

1. - 13. (canceled)
14. A communication card with standalone and master operational states, comprising:
   a controller;
   a flash storage unit, coupled with said controller, for storing data used by said controller;
   a wireless modem, coupled with said controller, for transmitting and receiving data over a wireless network in response to instructions received from said controller;
   a battery, coupled with said controller, with said flash storage unit and with said wireless modem, for supplying power to said controller, to said flash storage unit, and to said wireless modem; and
   a connector, coupled with said controller, for connecting the communication card to a host, wherein the communication card (i) operates in a standalone mode when said connector is not connected to the host, and (ii) operates as a master of the host when said connector is connected to the host, providing display information to the host.
15. The communication card of claim 14 further comprising circuitry for determining whether said connector is connected to the host.
16. The communication card of claim 14 wherein said battery supplies power to the host when the host is connected to said connector.
17. The communication card of claim 14 wherein the host has its own battery, and wherein said battery is charged by the host’s battery when the host is connected to said connector.
18. The communication card of claim 14 further comprising a USB connector coupled with said controller.
19. The communication card of claim 14 wherein said wireless modem comprises an audio player.
20. A method for determining the operational state of a communication card, comprising:
   providing a communication card that has at least two operational states, namely, (i) the communication card operating in a standalone mode, and (ii) the communication card connected to a host and operating as a master of the host;
   monitoring a signal on the communication card; and
   if the monitored signal has a voltage level lower than a designated threshold, then concluding that the communication card is in the standalone mode; otherwise, concluding that the communication card is connected to the host.
21. The method of claim 20 wherein the monitored signal is a battery voltage.
22. The method of claim 21 wherein the designated threshold is 0.5V.
23. A computer readable storage medium storing program code for causing a computing device to determine the state of a communication card that has at least two operational states, namely, (i) the communication card operating in a standalone mode, and (ii) the communication card connected to a host and operating as a master of the host, by:
   monitoring a signal on the communication card; and
   if the monitored signal has a voltage level lower than a designated threshold, then concluding that the communication card is in a standalone mode; otherwise, concluding that the communication card is connected to the host.
24. A communication card with standalone and master operational states, comprising:
   a card connector for connecting a communication card to a host, comprising a plurality of pins, the pins comprising: a connector for incoming and outgoing audio signals; a connector for a power supply; and a universal serial bus (USB) connector; a communication bus, wherein (i) no signals are routed to the communication bus when the card operates in a standalone mode, and (ii) secure digital (SD) card signals are routed to the communication bus when the card is connected to the host using a set of functionalities assigned to said connector pins, with the card operating as a master of the host; and circuitry for automatically detecting whether the card is operating in a standalone mode or in a master mode.
25. The communication card of claim 24 wherein said circuitry senses voltages across said connector pins.
26. The communication card of claim 24 wherein said set of functionalities comprises SD communication functionalities.
27. A communication system, comprising:
   a communication card comprising:
   a controller;
   a flash storage unit, coupled with said controller, for storing data used by said controller;
   a wireless modem, coupled with said controller, for transmitting and receiving data over a wireless network in response to instructions received from said controller;
   a battery, coupled with said controller, with said flash storage unit and with said wireless modem, for supplying power to said controller, to said flash storage unit, and to said wireless modem; and
   a host comprising:
   a plug for said card connector, for connecting the host to said communication card; and
   a user interface for said communication card,
wherein said communication card (i) operates in a standalone mode when said card connector is not connected to said host plug, and (ii) operates as a master of the host when said card connector is connected to said host plug, providing display information to the host.

28. The communication system of claim 27 wherein said host user interface comprises at least one speaker.

29. The communication system of claim 27 wherein said host user interface comprises a microphone.

30. The communication system of claim 27 further comprising a plurality of hosts, each host comprising:
   a plug for said card connector, for connecting the host to said communication card; and
   a different user interface for said communication card.

31. A communication system, comprising:
   a card connector for connecting a communication card to a host, comprising a plurality of pins;
   a communication bus, wherein (i) no signals are routed to the communication bus when the card operates in a standalone mode, and (ii) secure digital (SD) card signals are routed to the communication bus when the card is connected to the host using a set of functionalities assigned to said connector pins, with the card operating as a master of the host;
   circuitry for automatically detecting whether the card is operating in a standalone mode or in a master mode; and
   a host comprising:
   a plug for said card connector, for connecting the host to said communication card; and
   a user interface for said communication card.

32. The communication system of claim 31 wherein said host user interface comprises at least one speaker.

33. The communication system of claim 31 wherein said host user interface comprises a microphone.

34. The communication system of claim 31 further comprising a plurality of hosts, each host comprising:
   a plug for said card connector, for connecting the host to said communication card; and
   a different user interface for said communication card.

35. A host device for a communication card, comprising:
   a controller; and
   a connector, coupled with said controller, for connection with a wireless communication card,
   wherein said controller does not provide wireless communication functionality when said connector is not connected with the communication card, and wherein said controller operates as a slave to the communication card when said connector is connected to the communication card.

36. The host device of claim 35 further comprising a battery for supplying power to the wireless communication card, when said connector is connected to the wireless communication card.

37. The host device of claim 35 further comprising a display for displaying status information for the wireless communication card, when said connector is connected to the wireless communication card.

38. The host device of claim 35 further comprising a storage unit for storing data accessed by the wireless communication card, when said connector is connected to the wireless communication card.

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