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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017

CONFIRMATION NO. 3751

POWER OF ATTORNEY NOTICE



93689
HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

Date Mailed: 08/01/2013

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/24/2013.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/nhassani/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

TransCore LP
Exhibit 1023 (Page 1)

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017

CONFIRMATION NO. 3751

POA ACCEPTANCE LETTER

113760
HONEYWELL/OLIFF
101 Columbia Road
P.O. Box 2245
Morristown, NJ 07962-2245

OC000000062863228

Date Mailed: 08/01/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/24/2013.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/nhassani/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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Exhibit 1023 (Page 2)

PTO/AIA/80 (07-12)
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I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

■ Practitioners associated with Customer Number: 113760

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

■ The address associated with Customer Number: 113760

OR

☐

Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address: Hand Held Products, Inc.
9680 Old Bailes Road
Fort Mill, SC 29707

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record
The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	Jeremy C. Whitley	Date	March 25, 2013
Name	Jeremy C. Whitley	Telephone	(803) 835-8193
Title	Assistant Secretary - IP		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Ynjiun P. WANG et al.	Group Art Unit: 2887
Application No.: 12/567,158	Examiner: K. FRECH
Filed: September 25, 2009	Docket No.: H0022017

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

NOTICE OF CHANGE OF ADDRESS

Commissioner for Patents
P.O. Box 1450
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Sir:

Please address all future communications in connection with the above-identified application to:

OLIFF & BERRIDGE, PLC
CUSTOMER NUMBER 113760

Respectfully submitted,

R. Brian Drozd
Registration No. 55,130

RBD/cml

Date: July 24, 2013

OLIFF & BERRIDGE, PLC
P.O. Box 320850
Alexandria, Virginia 22320-4850
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry of this filing; Charge any fee due to our Deposit Account No. 15-0461

Electronic Acknowledgement Receipt	
EFS ID:	16399687
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	Robert Brian Drozd/Chandel Lawrence
Filer Authorized By:	Robert Brian Drozd
Attorney Docket Number:	H0022017
Receipt Date:	24-JUL-2013
Filing Date:	25-SEP-2009
Time Stamp:	11:52:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	158173_POA_Transmittal_072413.pdf	42239 3c9b9052db16abf513534c0a3a8db9a3d4beeff9	no	1
Warnings:					
Information:					

2	Power of Attorney	158173_GenPOA_072413.pdf	91531 7b45fe6b0d3cf550b9e27596aedea4fd153920a2	no	1
Warnings:					
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3	Change of Address	158179_Address_Change_072413.pdf	32979 78b49d62721a85b27b8ac3b1da80058f2e35ee0f	no	1
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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Ynjiun P. WANG et al.	Group Art Unit: 2887
Application No.: 12/567,158	Examiner: K. FRECH
Filed: September 25, 2009	Docket No.: H0022017

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

TRANSMITTAL OF POWER OF ATTORNEY AND STATEMENT UNDER 37 CFR § 3.73(b)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith is a Power of Attorney from the Assignee.

In compliance with 37 CFR §3.73(b), the undersigned hereby states that HAND HELD PRODUCTS, INC. is the assignee of the entire right, title and interest in the patent application identified above by virtue of an assignment from the inventors of the patent application identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 023285, Frame 0492.

The undersigned is authorized to act on behalf of the assignee.

In accordance with 37 CFR §1.36(a), submission of this Power of Attorney revokes any powers of attorney previously given.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO OLIFF & BERRIDGE, PLC, CUSTOMER NO. 113760, TELEPHONE (703) 836-6400.

Respectfully submitted,

R. Brian Drozd
Registration No. 55,130

RBD/cml

Date: July 24, 2013

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	03/27/2012	8141784	H0022017	3751

93689 7590 03/07/2012

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Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 19 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Ynjiun P. Wang, Cupertino, CA;
Huyu Qu, San Jose, CA;
James T. Sauerwein, Charlotte, NC;

IR103 (Rev. 10/09)

Amendment After Allowance Under 37 C.F.R. 1.312
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: February 9, 2012
Electronic Signature for Jessica Stives: /Jessica Stives/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 | Confirmation No.: 3751

Filed: September 25, 2009 | Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE | Examiner: Karl D. Frech

AMENDMENT AFTER ALLOWANCE UNDER 37 C.F.R. 1.312

MS Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

Prior to issuance of the patent, applicant respectfully requests entry on this amendment under 37 C.F.R. 1.312 for the above-captioned patent application.

Amendments to the Specification begin on page 2 of this paper.

Remarks/Arguments begin on page 3 of this paper.

OK TO ENTER: /K.F./

02/18/2012

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

93689 7590 02/24/2012

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Patent Services
101 Columbia Road
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Morristown, NJ 07962

EXAMINER	
FRECH, KARL D	
ART UNIT	PAPER NUMBER
2887	

NOTIFICATION DATE	DELIVERY MODE
02/24/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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mark.meagher@honeywell.com
DOCK@hrfmlaw.com

PTOL-90A (Rev. 04/07)

Response to Rule 312 Communication	Application No.	Applicant(s)
	12/567,158	WANG ET AL.
	Examiner	Art Unit
	KARL D. FRECH	2887

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

1. ☒ The amendment filed on *09 February 2012* under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

the substiture specification is entered.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

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SUBSTITUTE SPECIFICATION

ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

FIELD OF THE INVENTION

[0001] The invention is generally related to encoded information reading (EIR) terminals and is specifically related to an EIR terminal comprising a multi-protocol wireless communication interface.

BACKGROUND OF THE INVENTION

[0002] Encoded information reading (EIR) terminals equipped with wireless communication interfaces are widely used in retail stores, shipping facilities, etc. While wireless communication of EIR terminals offers many advantages as compared to wired communications, traditional wireless communication interfaces have noticeable shortcomings, *e.g.*, by failing to support more than one communication protocol and/or standard.

[0003] Accordingly, there is a need for further advances in EIR terminals and systems which would support multiple communication protocols and standards.

OK TO ENTER: /K.F./
02/18/2012

SUMMARY OF THE INVENTION

02/18/2012 [0004] In one embodiment, there is provided an encoded information reading (EIR) terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0005] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

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[0006] The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0007] The microprocessor can be configured to execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream.

[0008] The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0009] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0010] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0011] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be

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electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0012] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0013] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0014] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0015] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0016] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

[0017] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0018] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be

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configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0019] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0020] In a further embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0021] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0022] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

[0023] An encoded information reading (EIR) terminal can comprise a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface. The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message. The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus. The microprocessor can be configured to

execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream. The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] For the purpose of illustrating the invention, the drawings show aspects of one or more embodiments of the invention. However, it should be understood that the present invention is not limited to the precise arrangements and instrumentalities shown in the drawings, wherein:

[0025] Fig. 1 depicts a network level layout of a data collection system employing EIR terminal according to the invention;

[0026] Fig. 2 depicts a functional layout of a wireless communication interface;

[0027] Fig. 3 depicts a component level layout of an EIR terminal according to the invention;

[0028] Fig. 4 illustrates the functions of the base-band encoder software program according to the invention;

[0029] Fig. 5 illustrates the functions of the base-band encoder software program according to the invention;

[0030] Figs. 6a and 6b illustrate an exemplary hand held EIR terminal housing;

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[0031] Figs. 7a-7c illustrate an exemplary portable and remountable EIR terminal housing;

[0032] Fig. 8a illustrates a first exemplary deployment of an EIR terminal according to the invention within a retail store;

[0033] Fig. 8b illustrates a second exemplary deployment of an EIR terminal according to the invention within a retail store;

[0034] Figs. 8c and 8d illustrate PIN and signature data entry operational modes of an EIR terminal according to the invention.

[0035] The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the drawings, like numerals are used to indicate like parts throughout the various views.

DETAILED DESCRIPTION OF THE INVENTION

[0036] There is provided an encoded information reading (EIR) terminal for incorporation in a data collection system. The data collection system, schematically shown in Fig. 1, can include a plurality of EIR terminals 100a-100z in communication with a plurality of interconnected networks 110a-110z. In one aspect, the plurality of networks 110a-110z can include at least one IEEE 802.11 conformant wireless network. In another aspect, an EIR terminal 100a can be in communication with at least one wireless device over Bluetooth ™ wireless communication protocol. In a further aspect, the plurality of networks 110a-110z can include at least one GSM wireless network. In a further aspect, the plurality of networks 110a-110z can include at least one CDMA wireless network. Still further, the plurality of networks 110a-110z can include at least one 3G wireless network, *e.g.,* UMTS, HSUPA/HSDPA, or CDMA2000EvDO. In another aspect, the plurality of networks 110a-110z can include at least one 4G wireless network, *e.g.,* LTE, UWB, or 802.16m (WiMax). A skilled artisan would appreciate the fact that wireless networks implementing other wireless communication protocols are within the spirit and the scope of the invention.

[0037] In one aspect, an EIR terminal can comprise a wireless communication interface. The EIR terminal 100c can establish a communication session with the host computer 171. In one embodiment, network frames can be exchanged by the EIR terminal 100c and the host

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computer 171 via one or more routers, base stations, and other infrastructure elements. In another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a local area network (LAN). In a yet another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a wide area network (WAN). A skilled artisan would appreciate the fact that other methods of providing interconnectivity between the EIR terminal 100c and the host computer 171 relying upon LANs, WANs, virtual private networks (VPNs), and/or other types of network are within the spirit and the scope of the invention.

[0038] In a further aspect, the wireless communication interface can be configured to support at least two wireless communication protocols. In one embodiment, the wireless communication interface can be configured to support HSPA/GSM/GPRS/EDGE protocol family and CDMA/EV-DO protocol family. A skilled artisan would appreciate the fact that wireless communication interfaces supporting other communication protocols are within the spirit and the scope of the invention.

[0039] In one embodiment, the communications between the EIR terminal 100c and the host computer 171 can comprise a series of HTTP requests and responses transmitted over one or more TCP connections, although a person skilled in the art would appreciate the fact that using other transport and application level protocols is within the scope and the spirit of the invention.

[0040] In one aspect, at least one of the messages transmitted by the EIR terminal can include decoded message data corresponding to, *e.g.*, a bar code label or an RFID label attached to a product or to a shipment item. For example, an EIR terminal can transmit a request to the host computer to retrieve product information corresponding to a product identifier encoded by a bar code label attached to the product, or to transmit an item tracking record for an item identified by a bar code label attached to the product.

[0041] A wireless communication interface 210 best viewed in Fig. 2, can comprise a transmitter circuit 220 electrically coupled to a data source 221. The transmitter circuit 220 can be implemented by one or more specialized microchips, and can perform the following functions: source encoding 223, encryption 226, channel encoding 229, multiplexing 232, modulation 235, and frequency spreading 238.

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[0042] The wireless communication interface 210 of Fig. 2 can further comprise a receiver circuit 250 electrically coupled to the data sink 271. The receiver circuit 250 can be implemented by one or more specialized microchips, and can perform the following functions: frequency de-spreading 253, demodulation 256, de-multiplexing 259, channel decoding 262, decryption 265, and source decoding 268.

[0043] Each of the transmitter circuit 220 and receiver circuit 250 can be electrically coupled to a radio frequency (RF) front end 299. The RF front end 299 can be used to convert high frequency RF signals to/from base-band or intermediate frequency signals. A skilled artisan would appreciate the fact that RF front ends of different data rates, sensitivities, output powers, operating frequencies, and measurement resolutions are within the scope and spirit of the invention.

[0044] On the receiving side, the RF front-end 299 can include all filters, low-noise amplifiers (LNAs), and down-conversion mixer(s) needed to process modulated RF signals received by the antenna into based-band signals. In one embodiment, the receiving part of the RF front end 299 can comprise one or more of the following components:

- a first matching circuit to transfer to the next stage the energy received by the antenna;
- a band-pass filter (BPF) to knock down out-of-band jammers;
- a second matching circuit at the input of a low-noise amplifier (LNA);
- the LNA, the primary responsibility of which is to set the sensitivity of the receiver, by providing a high gain;
- a third matching circuit between the LNA output and the receive (RX) mixer (down-converter);
- the down-conversion RX mixer.

[0045] On the transmitting side, the RF frond-end area can be described as a "mirrored" version of a receiver. The front end of a transmitter up converts an outgoing base-band signal and then feeds the signal to a high power amplifier. A skilled artisan would appreciate the

fact that other ways of implementing the RF front end are within the spirit and the scope of the invention.

[0046] According to one embodiment of the invention, the wireless communication interface supporting at least two wireless communication protocols can be implemented using a single dual-protocol (or multi-protocol) chipset. The chipset can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0047] In another embodiment, the wireless communication interface supporting at least two wireless communication protocols can be implemented using two or more chipsets. Each of the chipsets can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0048] In a yet another embodiment, at least some of the functions of the transmitter circuit and the receiver circuit can be advantageously performed by one or more software programs executed by a microprocessor. In one embodiment the EIR terminal 100 can comprise at least one microprocessor 310 and a memory 320, both coupled to the system bus 370, as best viewed in Fig. 3.

[0049] The microprocessor 310 can be provided by a general purpose microprocessor or by a specialized microprocessor (*e.g.*, an ASIC). In one embodiment, the EIR terminal 100 can comprise a single microprocessor which can be referred to as a central processing unit (CPU) and which can perform at least some of the functions of the transmitter circuit and the receiver circuit. In another embodiment, the EIR terminal 100 can comprise two or more microprocessors; for example, a CPU providing some or most of the EIR functionality and a specialized microprocessor performing some of the functions of the transmitter circuit and the receiver circuit. A skilled artisan would appreciate the fact that different schemes of processing tasks distribution among the two or more microprocessors are within the spirit and the scope of the invention.

[0050] The EIR terminal 100 can further comprise one or more encoded information reading (EIR) devices 330, including a bar code reading device, an RFID reading device, and a card reading device, also coupled to the system bus 370. In one embodiment, an EIR reading device can be capable of outputting decoded message data corresponding to an

encoded message. In another embodiment, the EIR reading device can output raw message data containing an encoded message, *e.g.*, raw image data or raw RFID data.

[0051] Of course, devices that read bar codes, read RFID, or read cards bearing encoded information may read more than one of these categories while remaining within the scope of the invention. For example, a device that reads bar codes may include a card reader, and/or RFID reader; a device that reads RFID may also be able to read bar codes and/or cards; and a device that reads cards may be able to also read bar codes and/or RFID. For further clarity, it is not necessary that a device's primary function involve any of these functions in order to be considered such a device; for example, a cellular telephone, smartphone, or PDA that is capable of reading bar codes is a device that reads bar codes for purposes of the present invention

[0052] The EIR terminal 100 can further comprise a keyboard interface 354 and a display adapter 355, both also coupled to the system bus 370. The EIR terminal 100 can further comprise a battery 356.

[0053] In a further aspect, the EIR terminal 100 can further comprise an RF front end 340. In a further aspect, the EIR terminal 100 can further comprise an analog-to-digital (ADC) converter 350, the input of which can be electrically coupled to the RF front end 340. The choice of ADC can be determined by the receiver architecture, and can depend upon the selectivity of the filters, the dynamic range afforded by the front-end amplifiers, and the bandwidth and type of modulation to be processed. For example, the level or dynamic range of signals expected to be presented to the ADC will dictate the bit resolution needed for the converter. An ADC can also be specified in terms of its spurious-free dynamic range (SFDR). The ADC's sensitivity can be influenced by wideband noise, including spurious noise, and can be improved through the use of an anti-aliasing filter at the input of the ADC to eliminate sampling of noise and high-frequency spurious products. To avoid aliasing when converting analog signals to the digital domain, the ADC sampling frequency must be at least twice the maximum frequency of the input analog signal. This minimum sampling condition derived from Nyquist's theorem, must be met in order to capture enough information about the input analog waveform to reconstruct it accurately. In addition to selecting an ADC for IF or baseband sampling, the choice of buffer amplifier to feed the input of the converter can affect the performance possible with a given sampling scheme. The buffer amplifier should

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provide the rise/fall time and transient response to preserve the modulation information of the IF or base-band signals, while also providing the good amplitude accuracy and flatness needed to provide signal amplitudes at an optimum input level to the ADC for sampling.

[0054] In another embodiment, the EIR terminal 100 can further comprise a digital-to-analog (DAC) converter 360, the output of which can be electrically coupled to the RF front end 340. In a further aspect, a DAC can be viewed as a component providing a function reversed to that of an ADC.

[0055] In a further aspect, the output of the ADC 350, and the input of the DAC 360 can be electrically coupled to a system bus 370. A skilled artisan would appreciate the fact that other microprocessors, memory, and/or peripheral devices can be electrically coupled to the system bus 370 without departing from the scope and the spirit of the invention.

[0056] In another aspect, the microprocessor 310 can execute a base-band encoder software program which can encode a bit stream which needs to be transmitted over a wireless medium. The encoded bit stream outputted by the base-band encoder software program can be fed to the input of the DAC 360. The analog signal representative of the encoded bit stream can be outputted by the DAC 360 to the RF front end 340 in order to be transmitted over a wireless medium.

[0057] In one embodiment, the base-band encoder software program 400 can perform at least one of the following functions schematically shown in Fig. 4: source encoding 410 of a bit stream 405, encryption 420, channel encoding 430, multiplexing 440, modulation 450, frequency spreading 460, and media access control 470. In one embodiment, the remaining functions (*i.e.,* those not implemented by the base-band encoder software program) can be implemented by one or more dedicated hardware components.

[0058] In one aspect, the source encoding function 410 can be provided by a process of encoding information using a different number of bits (or other information bearing units) than an un-encoded representation would use, through use of specific encoding schemes.

[0059] In another aspect, the encryption function 420 can be implemented by using an algorithm (cipher) suitable to transform an unencrypted ("plain text") information stream to an encrypted information stream.

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[0060] In a further aspect, the channel encoding function 430 can be provided by a process suitable to encode the transmitted information stream into a form, which would allow guaranteed reliable information transmission at a rate close to the maximum channel capacity. According to the Shannon theorem, for a given bandwidth and signal-to-noisy ratio, the theoretical maximum channel capacity (reliable information transfer rate) for a particular noise level is defined by the following equation:

$$C = B\log_2(1+\tfrac{S}{N}).$$

[0061] For any information transmission rate R < C, there exists an encoding scheme that would allow the probability of errors at the receiver to be made less than a pre-defined value ε. The channel encoding function 430 can select and/or implement an encoding scheme for a pre-defined value of ε.

[0062] In a further aspect, the multiplexing function 440 can be employed to combine multiple signals or data streams into one signal transmitted over a shared physical transmission medium (wireless channel). The multiplexing function 440 can implement one or more of the multiplexing technologies including TDMA (Time division multiple access), FDMA (Frequency division multiple access), CDMA (Code division multiple access), CSMA (Carrier sense multiple access), etc.

[0063] In a further aspect, the frequency spreading function 460 can implement one or more of the following technologies: DSSS (Direct Sequence Spread Spectrum), FHSS (Frequency Hopping Spread Spectrum), and OFDM (Orthogonal Frequency Division Multiplexing).

[0064] In a further aspect, the media access control function 470 can provide addressing and channel access control mechanisms.

[0065] In another aspect, the RF front end 340 can output to the ADC 350 an analog signal representative of a signal received over the wireless medium. The ADC 350 can output a digital signal representative of the analog signal outputted by the RF front end 340. The microprocessor 310 can execute a base-band decoder software program which can input the digital signal outputted by the ADC 350 and can decode the digital signal into a form suitable for further processing by other software programs.

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[0066] In a further aspect, the base-band decoder software program 500 can perform at least at least one of the following functions schematically shown in Fig. 5: media access control 510, frequency de-spreading 520, de-modulation 530, de-multiplexing 540 the analog signal, channel decoding 560, decryption 570, and source decoding 580. In one embodiment, the remaining functions (*i.e.*, those not implemented by the base-band decoder software program) can be implemented by one or more dedicated hardware components.

[0067] In one aspect, each of the frequency de-spreading 520, de-modulation 530, de-multiplexing 540, channel decoding 560, decryption 570, and source decoding 580 functions can be implemented as a reverse function of the frequency spreading 460, modulation 450, multiplexing 440, channel encoding 430, encryption 420, source encoding 410 functions, respectively.

[0068] In another aspect, the base-band encoder software program can be implemented as two or more software programs. In another aspect, the base-band decoder software program can be implemented as two or more software programs. In a further aspect, the base-band encoder software program and the base-band decoder software program can be implemented as a single software program.

[0069] In another aspect, due to advantageously performing at least some of the source bit stream encoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control.

[0070] In another aspect, due to advantageously performing at least some of the analog signal decoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0071] In a further aspect, the EIR terminal 100 can be configured to dynamically select a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol (*e.g.*, frequency or transmission power) to be used by the RF front end 340.

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[0072] Due to its ability to dynamically select a wireless communication network and a wireless communication protocol, the EIR terminal 100 according to the present invention can be advantageously used, *e.g.*, by a company operating in several geographies with different wireless communication standards. Using the EIR terminal 100 according to the present invention would allow such a company to deploy the same EIR terminal 100 model in all the geographies.

[0073] In one embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of a wireless communication protocol can be performed manually by the user of the EIR terminal 100. In one embodiment, the selection can be performed by scanning a pre-defined bar code. In another embodiment, the selection can be performed by the user interacting with the user interface (*e.g.*, via a graphical user interface (GUI), or via a hardware-implemented control). A skilled artisan would appreciate the fact that other methods of manually selecting a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol are within the scope and the spirit of the invention.

[0074] In another embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol can be performed by a wireless communication protocol selector software program executed by the EIR terminal 100. The wireless communication protocol selector software program can optimize a value of a user-defined criterion.

[0075] In one embodiment, the value of the user-defined criterion can be calculated based on one or more of the following parameters: frequency range, network status, signal strength, service cost, communication channel throughput, and user preferences. The user preferences can be represented, *e.g.*, by network preference, service preference, protocol preference, or frequency preference. A skilled artisan would appreciate the fact that other types of user preferences are within the spirit and the scope of the invention.

[0076] In one embodiment, the value of the user-defined criterion can be calculated as a weighted sum of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). In another embodiment, the value

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of the user-defined criterion can be calculated as a square root of a weighted sum of squares of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). A skilled artisan would appreciate the fact that other methods of calculating the user-defined criterion value are within the scope and spirit of the invention.

[0077] For example, if a user is more concerned about the cost than about other communication parameters, the user would want the user-defined criterion to yield the cheapest covered service provider (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or network selection). In another example, if a user is more concerned about the signal quality than about other communication parameters, the user would want the user-defined criterion to yield the network with best quality (while the cost can be a secondary factor affecting the service provider and/or network selection). In a yet another example, if a user is more concerned about maintaining uninterrupted communication session than about other communication parameters, the user would want the user-defined criterion to yield the network with best connection reliability (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or network selection). A skilled artisan would appreciate the fact that other methods of defining the user-defined criterion are within the scope and the spirit of the invention.

[0078] In one embodiment, the EIR terminal 100 can be configured to search beacon signals over a pre-defined frequency range (*e.g.*, between 800MHz and 5GHz), and then select a wireless communication network and/or frequency channel which would produce the optimal value of the user-defined criterion.

[0079] In one embodiment, the value of the user-defined criterion can be calculated immediately before the EIR terminal 100 attempts to initiate a communication session, so that a wireless communication network and/or a wireless communication protocol can be chosen which would optimize the user-defined criterion.

[0080] In another embodiment, the value of the user-defined criterion can be calculated periodically at established time intervals so that the EIR terminal 100 can change the wireless

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communication network and/or the wireless communication protocol between communication sessions or during a communication session if a wireless communication network and/or a wireless communication protocol is detected yielding a value of the user-defined criterion which is closer to the optimum than that of the current network or protocol. In yet another embodiment, the value of a user-defined criterion can be calculated responsive to a pre-defined event (*e.g.*, the signal quality falling below a pre-defined level, or the signal quality exceeding a pre-defined threshold), so that the EIR terminal 100 can automatically (*i.e.*, without user intervention) change the wireless communication network and/or the wireless communication protocol between communication sessions or during a communication session. Thus, the EIR terminal 100 can always maintain a network connection irrespectively of changing external conditions (*e.g.*, when the terminal is physically moved).

[0081] Form factors and housings for the EIR terminal 100 according to the invention are now being described. The components of EIR terminal 100 can be incorporated into a variety of different housings. As indicated by the embodiment of Figs. 6a and 6b, the components of Fig. 5 can be incorporated into a hand held housing 101. EIR terminal 100 of Figs. 6a and 6b is in the form factor of a hand held portable data terminal. EIR terminal 100 as shown in Figs. 6a and 6b includes a keyboard 1090, a display 504 having an associated touch screen overlay, a card reader 1348, and an imaging module 360 which includes the components of imaging assembly as described herein; namely, image sensor array incorporated on an image sensor IC chip. Imaging module 360 has an associated imaging axis, a_i. As indicated by the side view of Fig. 6b, the components of the block diagram of Fig. 5 may be supported within housing 101 on a plurality of circuit boards 1077. Imaging module 360 may include an image sensor array having color sensitive pixels as described in U. S. Provisional Patent Application Nos. 60/687,606, filed June 3, 2005, 60/690,268, filed June 14, 2005, 60/692,890, filed June 22, 2005, and 60/694,371, filed June 27, 2005, all of which are entitled Digital Picture Taking Optical Reader Having Hybrid Monochrome And Color Image Sensor, and all of which are incorporated herein by reference.

[0082] In the embodiment of Figs. 7a-7c, the EIR terminal 100 is in the form of a transaction terminal which may be configured as a retail purchase transaction terminal or as a price verifier. Housing 102 of the transaction terminal shown in Figs. 7a-7c is configured to

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be portable so that it can be moved from location to location and is further configured to be replaceably mounted on a fixed structure such as a fixed structure of a cashier station or a fixed structure of the retail store floor (*e.g.*, a shelf, a column 264 best viewed in Fig. 8b). Referring to bottom view of Fig. 7c, the housing 102 of the EIR terminal 100 has formations 268 facilitating the replaceable mounting of EIR terminal 100 on a fixed structure. Referring now to Fig. 7b, EIR terminal 100 includes a display 504 having an associated touch screen 504T, a card reader 1348, an imaging module 360, and a luminous shroud 362. When light from the illumination block (not shown in Fig. 8) strikes luminous shroud 362, the shroud glows to attract attention to the location of imaging assembly. In certain operating modes as indicated in Fig. 8c, the EIR terminal 100 in accordance with any of Figs. 7a-7c, displays on display 504 a PIN entry screen prompting a customer to enter PIN information into touch screen 504T. In other operating modes, as indicated in Fig. 8d, the EIR terminal 100 displays on display 504 a signature prompt screen prompting a customer to enter signature information into the device with use of a stylus 505.

[0083] Referring to Figs. 8a and 8b, various installation configurations for the EIR terminal of Figs. 7a-7c are shown. In the view of Fig. 8a, the EIR terminal 100 is installed as a retail purchase transaction terminal at a point of sale cashier station. In the setup of Fig. 8a, the EIR terminal 100 is configured as a retail purchase transaction terminal and is utilized to aid and facilitate retail transactions at a point of sale. A customer may enter a credit card or a debit card into card reader 1348 and retail purchase transaction terminal may transmit the credit card information to credit/debit authorization network.

[0084] In the view of Fig. 8b, the EIR terminal 100 is configured as a price verifier to aid customers in checking prices of products located on a store floor. EIR terminal 100 may be mounted on a shelf (not shown in Fig. 8b) or on a column 254 or other fixed structure of the retail store. EIR terminal 100 may decode bar code data from bar codes on store products and transmit decoded out bar code messages to a store server for lookup of price information which is sent back from the store server to terminal 100 for display on display 504.

[0085] While the present invention has been particularly shown and described with reference to certain exemplary embodiments, it will be understood by one skilled in the art that various changes in detail may be affected therein without departing from the spirit and scope of the invention as defined by claims that can be supported by the written description

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and drawings. Further, where exemplary embodiments are described with reference to a certain number of elements it will be understood that the exemplary embodiments can be practiced utilizing less than the certain number of elements.

[0086] A small sample of systems methods and apparatus that are described herein is as follows:

A1. An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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A2. The EIR terminal of claim A1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

A3. The EIR terminal of claim A1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

A4. The EIR terminal of claim A1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A5. The EIR terminal of claim A1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A6. The EIR terminal of claim A1 further comprising a central processing unit (CPU); wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

A7. The EIR terminal of claim A1 further comprising a central processing unit (CPU); wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

A8. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

A9. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at

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least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A10. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A11. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of a network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

A12. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at

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least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A13. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A14. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

A15. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

A16. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program

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configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

A17. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

A18. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to periodically evaluate said user-defined criterion.

A19. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

A20. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

B1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

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a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

B2. The EIR terminal of claim B1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

B3. The EIR terminal of claim B1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B4. The EIR terminal of claim B1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B5. The EIR terminal of claim B1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

B6. The EIR terminal of claim B1 further comprising a central processing unit (CPU);

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wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

B7. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B8. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B9. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

B10. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B11. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B12. The EIR terminal of claim B1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

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B13. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

B14. The EIR terminal of claim B1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

B15. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

B16. The EIR terminal of claim B1 further configured to periodically evaluate said user-defined criterion.

B17. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

B18. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

C1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

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wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

C2. The EIR terminal of claim C1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C3. The EIR terminal of claim C1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C4. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

C5. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

D1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically

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select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

D2. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

D3. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using two or more chipsets.

D4. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D5. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D6. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

D7. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D8. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

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D9. The EIR terminal of claim D1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

D10. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

D11. The EIR terminal of claim D1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

D12. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

D13. The EIR terminal of claim D1 further configured to periodically evaluate said user-defined criterion.

D14. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

D15. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

E1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

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a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

E2. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

E3. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using two or more chipsets.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

TITLE OF INVENTION: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$230	$0	$1510	$230	02/09/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRECH, KARL D	2887	235-462250

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
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(A) NAME OF ASSIGNEE: Hand Held Products, Inc.
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☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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Authorized Signature /George S. Blasiak/ Date February 9, 2012

Typed or printed name George S. Blasiak Registration No. 37,283

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Electronic Acknowledgement Receipt	
EFS ID:	12039787
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	George S. Blasiak/Jessica Stives
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		4283687_H0022017_Amendment.pdf	54187 3d7394fc60bf0bfd69a01db9a0164ea1acd56b43	yes	3

	Multipart Description/PDF files in .zip description			
	Document Description	Start	End	
	Amendment after Notice of Allowance (Rule 312)	1	1	
	Specification	2	2	
	Applicant Arguments/Remarks Made in an Amendment	3	3	
Warnings:				
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2	Specification	4283687_H0022017_MarkedUpSubstituteSpecification.pdf	155734 c781d80062338f7e317b831e4e44c5a546eee798	no	36
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3	Specification	4283687_H0022017_SubstituteSpecification.pdf	155732 9a9f6eee40ca2b198174b483c5e82fc23fca3575	no	36
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Amendment After Allowance Under 37 C.F.R. 1.312
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: February 9, 2012
Electronic Signature for Jessica Stives: /Jessica Stives/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: Karl D. Frech

AMENDMENT AFTER ALLOWANCE UNDER 37 C.F.R. 1.312

MS Issue Fee
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Sir:

INTRODUCTORY COMMENTS

Prior to issuance of the patent, applicant respectfully requests entry on this amendment under 37 C.F.R. 1.312 for the above-captioned patent application.

Amendments to the Specification begin on page 2 of this paper.

Remarks/Arguments begin on page 3 of this paper.

AMENDMENTS TO THE SPECIFICATION

Attached is a Substitute Specification and a Substitute Specification Marked to Show Changes.

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REMARKS

An amendment is presented herein to include the text of the original Abstract in the Summary. The Examiner for compliance with MPEP 608.01(b) in an Examiner amendment of August 12, 2011 removed text from the Abstract and the applicants desire that text of the original application be presented in the issuing patent.

No amendment presented herein contains new matter.

Accordingly, in view of the above amendments and remarks, applicant believes all of the claims of the present application to be in condition for allowance and respectfully request reconsideration and passage to allowance of the application.

If the Examiner believes that contact with applicant's attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call applicant's representative at the phone number listed below.

Applicants believe no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 08-1935.

Dated: February 9, 2012

GB/js

Respectfully submitted,
Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283
HESLIN ROTHENBERG
FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
(518) 452-5600
Customer No.: 93689

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SUBSTITUTE SPECIFICATION MARKED TO SHOW CHANGES

ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

FIELD OF THE INVENTION

[0001] The invention is generally related to encoded information reading (EIR) terminals and is specifically related to an EIR terminal comprising a multi-protocol wireless communication interface.

BACKGROUND OF THE INVENTION

[0002] Encoded information reading (EIR) terminals equipped with wireless communication interfaces are widely used in retail stores, shipping facilities, etc. While wireless communication of EIR terminals offers many advantages as compared to wired communications, traditional wireless communication interfaces have noticeable shortcomings, *e.g.*, by failing to support more than one communication protocol and/or standard.

[0003] Accordingly, there is a need for further advances in EIR terminals and systems which would support multiple communication protocols and standards.

SUMMARY OF THE INVENTION

[0004] In one embodiment, there is provided an encoded information reading (EIR) terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0005] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

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[0006] The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0007] The microprocessor can be configured to execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream.

[0008] The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0009] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0010] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0011] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be

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electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0012] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0013] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0014] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0015] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0016] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

[0017] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0018] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be

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configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0019] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0020] In a further embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0021] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0022] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

[0023] An encoded information reading (EIR) terminal can comprise a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface. The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message. The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus. The microprocessor can be configured to

execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream. The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] For the purpose of illustrating the invention, the drawings show aspects of one or more embodiments of the invention. However, it should be understood that the present invention is not limited to the precise arrangements and instrumentalities shown in the drawings, wherein:

[0025] Fig. 1 depicts a network level layout of a data collection system employing EIR terminal according to the invention;

[0026] Fig. 2 depicts a functional layout of a wireless communication interface;

[0027] Fig. 3 depicts a component level layout of an EIR terminal according to the invention;

[0028] Fig. 4 illustrates the functions of the base-band encoder software program according to the invention;

[0029] Fig. 5 illustrates the functions of the base-band encoder software program according to the invention;

[0030] Figs. 6a and 6b illustrate an exemplary hand held EIR terminal housing;

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[0031] Figs. 7a-7c illustrate an exemplary portable and remountable EIR terminal housing;

[0032] Fig. 8a illustrates a first exemplary deployment of an EIR terminal according to the invention within a retail store;

[0033] Fig. 8b illustrates a second exemplary deployment of an EIR terminal according to the invention within a retail store;

[0034] Figs. 8c and 8d illustrate PIN and signature data entry operational modes of an EIR terminal according to the invention.

[0035] The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the drawings, like numerals are used to indicate like parts throughout the various views.

DETAILED DESCRIPTION OF THE INVENTION

[0036] There is provided an encoded information reading (EIR) terminal for incorporation in a data collection system. The data collection system, schematically shown in Fig. 1, can include a plurality of EIR terminals 100a-100z in communication with a plurality of interconnected networks 110a-110z. In one aspect, the plurality of networks 110a-110z can include at least one IEEE 802.11 conformant wireless network. In another aspect, an EIR terminal 100a can be in communication with at least one wireless device over Bluetooth ™ wireless communication protocol. In a further aspect, the plurality of networks 110a-110z can include at least one GSM wireless network. In a further aspect, the plurality of networks 110a-110z can include at least one CDMA wireless network. Still further, the plurality of networks 110a-110z can include at least one 3G wireless network, *e.g.,* UMTS, HSUPA/HSDPA, or CDMA2000EvDO. In another aspect, the plurality of networks 110a-110z can include at least one 4G wireless network, *e.g.,* LTE, UWB, or 802.16m (WiMax). A skilled artisan would appreciate the fact that wireless networks implementing other wireless communication protocols are within the spirit and the scope of the invention.

[0037] In one aspect, an EIR terminal can comprise a wireless communication interface. The EIR terminal 100c can establish a communication session with the host computer 171. In one embodiment, network frames can be exchanged by the EIR terminal 100c and the host

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computer 171 via one or more routers, base stations, and other infrastructure elements. In another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a local area network (LAN). In a yet another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a wide area network (WAN). A skilled artisan would appreciate the fact that other methods of providing interconnectivity between the EIR terminal 100c and the host computer 171 relying upon LANs, WANs, virtual private networks (VPNs), and/or other types of network are within the spirit and the scope of the invention.

[0038] In a further aspect, the wireless communication interface can be configured to support at least two wireless communication protocols. In one embodiment, the wireless communication interface can be configured to support HSPA/GSM/GPRS/EDGE protocol family and CDMA/EV-DO protocol family. A skilled artisan would appreciate the fact that wireless communication interfaces supporting other communication protocols are within the spirit and the scope of the invention.

[0039] In one embodiment, the communications between the EIR terminal 100c and the host computer 171 can comprise a series of HTTP requests and responses transmitted over one or more TCP connections, although a person skilled in the art would appreciate the fact that using other transport and application level protocols is within the scope and the spirit of the invention.

[0040] In one aspect, at least one of the messages transmitted by the EIR terminal can include decoded message data corresponding to, *e.g.*, a bar code label or an RFID label attached to a product or to a shipment item. For example, an EIR terminal can transmit a request to the host computer to retrieve product information corresponding to a product identifier encoded by a bar code label attached to the product, or to transmit an item tracking record for an item identified by a bar code label attached to the product.

[0041] A wireless communication interface 210 best viewed in Fig. 2, can comprise a transmitter circuit 220 electrically coupled to a data source 221. The transmitter circuit 220 can be implemented by one or more specialized microchips, and can perform the following functions: source encoding 223, encryption 226, channel encoding 229, multiplexing 232, modulation 235, and frequency spreading 238.

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[0042] The wireless communication interface 210 of Fig. 2 can further comprise a receiver circuit 250 electrically coupled to the data sink 271. The receiver circuit 250 can be implemented by one or more specialized microchips, and can perform the following functions: frequency de-spreading 253, demodulation 256, de-multiplexing 259, channel decoding 262, decryption 265, and source decoding 268.

[0043] Each of the transmitter circuit 220 and receiver circuit 250 can be electrically coupled to a radio frequency (RF) front end 299. The RF front end 299 can be used to convert high frequency RF signals to/from base-band or intermediate frequency signals. A skilled artisan would appreciate the fact that RF front ends of different data rates, sensitivities, output powers, operating frequencies, and measurement resolutions are within the scope and spirit of the invention.

[0044] On the receiving side, the RF front-end 299 can include all filters, low-noise amplifiers (LNAs), and down-conversion mixer(s) needed to process modulated RF signals received by the antenna into based-band signals. In one embodiment, the receiving part of the RF front end 299 can comprise one or more of the following components:

- a first matching circuit to transfer to the next stage the energy received by the antenna;
- a band-pass filter (BPF) to knock down out-of-band jammers;
- a second matching circuit at the input of a low-noise amplifier (LNA);
- the LNA, the primary responsibility of which is to set the sensitivity of the receiver, by providing a high gain;
- a third matching circuit between the LNA output and the receive (RX) mixer (down-converter);
- the down-conversion RX mixer.

[0045] On the transmitting side, the RF frond-end area can be described as a "mirrored" version of a receiver. The front end of a transmitter up converts an outgoing base-band signal and then feeds the signal to a high power amplifier. A skilled artisan would appreciate the

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fact that other ways of implementing the RF front end are within the spirit and the scope of the invention.

[0046] According to one embodiment of the invention, the wireless communication interface supporting at least two wireless communication protocols can be implemented using a single dual-protocol (or multi-protocol) chipset. The chipset can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0047] In another embodiment, the wireless communication interface supporting at least two wireless communication protocols can be implemented using two or more chipsets. Each of the chipsets can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0048] In a yet another embodiment, at least some of the functions of the transmitter circuit and the receiver circuit can be advantageously performed by one or more software programs executed by a microprocessor. In one embodiment the EIR terminal 100 can comprise at least one microprocessor 310 and a memory 320, both coupled to the system bus 370, as best viewed in Fig. 3.

[0049] The microprocessor 310 can be provided by a general purpose microprocessor or by a specialized microprocessor (*e.g.*, an ASIC). In one embodiment, the EIR terminal 100 can comprise a single microprocessor which can be referred to as a central processing unit (CPU) and which can perform at least some of the functions of the transmitter circuit and the receiver circuit. In another embodiment, the EIR terminal 100 can comprise two or more microprocessors; for example, a CPU providing some or most of the EIR functionality and a specialized microprocessor performing some of the functions of the transmitter circuit and the receiver circuit. A skilled artisan would appreciate the fact that different schemes of processing tasks distribution among the two or more microprocessors are within the spirit and the scope of the invention.

[0050] The EIR terminal 100 can further comprise one or more encoded information reading (EIR) devices 330, including a bar code reading device, an RFID reading device, and a card reading device, also coupled to the system bus 370. In one embodiment, an EIR reading device can be capable of outputting decoded message data corresponding to an

encoded message. In another embodiment, the EIR reading device can output raw message data containing an encoded message, *e.g.*, raw image data or raw RFID data.

[0051] Of course, devices that read bar codes, read RFID, or read cards bearing encoded information may read more than one of these categories while remaining within the scope of the invention. For example, a device that reads bar codes may include a card reader, and/or RFID reader; a device that reads RFID may also be able to read bar codes and/or cards; and a device that reads cards may be able to also read bar codes and/or RFID. For further clarity, it is not necessary that a device's primary function involve any of these functions in order to be considered such a device; for example, a cellular telephone, smartphone, or PDA that is capable of reading bar codes is a device that reads bar codes for purposes of the present invention

[0052] The EIR terminal 100 can further comprise a keyboard interface 354 and a display adapter 355, both also coupled to the system bus 370. The EIR terminal 100 can further comprise a battery 356.

[0053] In a further aspect, the EIR terminal 100 can further comprise an RF front end 340. In a further aspect, the EIR terminal 100 can further comprise an analog-to-digital (ADC) converter 350, the input of which can be electrically coupled to the RF front end 340. The choice of ADC can be determined by the receiver architecture, and can depend upon the selectivity of the filters, the dynamic range afforded by the front-end amplifiers, and the bandwidth and type of modulation to be processed. For example, the level or dynamic range of signals expected to be presented to the ADC will dictate the bit resolution needed for the converter. An ADC can also be specified in terms of its spurious-free dynamic range (SFDR). The ADC's sensitivity can be influenced by wideband noise, including spurious noise, and can be improved through the use of an anti-aliasing filter at the input of the ADC to eliminate sampling of noise and high-frequency spurious products. To avoid aliasing when converting analog signals to the digital domain, the ADC sampling frequency must be at least twice the maximum frequency of the input analog signal. This minimum sampling condition derived from Nyquist's theorem, must be met in order to capture enough information about the input analog waveform to reconstruct it accurately. In addition to selecting an ADC for IF or baseband sampling, the choice of buffer amplifier to feed the input of the converter can affect the performance possible with a given sampling scheme. The buffer amplifier should

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provide the rise/fall time and transient response to preserve the modulation information of the IF or base-band signals, while also providing the good amplitude accuracy and flatness needed to provide signal amplitudes at an optimum input level to the ADC for sampling.

[0054] In another embodiment, the EIR terminal 100 can further comprise a digital-to-analog (DAC) converter 360, the output of which can be electrically coupled to the RF front end 340. In a further aspect, a DAC can be viewed as a component providing a function reversed to that of an ADC.

[0055] In a further aspect, the output of the ADC 350, and the input of the DAC 360 can be electrically coupled to a system bus 370. A skilled artisan would appreciate the fact that other microprocessors, memory, and/or peripheral devices can be electrically coupled to the system bus 370 without departing from the scope and the spirit of the invention.

[0056] In another aspect, the microprocessor 310 can execute a base-band encoder software program which can encode a bit stream which needs to be transmitted over a wireless medium. The encoded bit stream outputted by the base-band encoder software program can be fed to the input of the DAC 360. The analog signal representative of the encoded bit stream can be outputted by the DAC 360 to the RF front end 340 in order to be transmitted over a wireless medium.

[0057] In one embodiment, the base-band encoder software program 400 can perform at least one of the following functions schematically shown in Fig. 4: source encoding 410 of a bit stream 405, encryption 420, channel encoding 430, multiplexing 440, modulation 450, frequency spreading 460, and media access control 470. In one embodiment, the remaining functions (*i.e.,* those not implemented by the base-band encoder software program) can be implemented by one or more dedicated hardware components.

[0058] In one aspect, the source encoding function 410 can be provided by a process of encoding information using a different number of bits (or other information bearing units) than an un-encoded representation would use, through use of specific encoding schemes.

[0059] In another aspect, the encryption function 420 can be implemented by using an algorithm (cipher) suitable to transform an unencrypted ("plain text") information stream to an encrypted information stream.

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[0060] In a further aspect, the channel encoding function 430 can be provided by a process suitable to encode the transmitted information stream into a form, which would allow guaranteed reliable information transmission at a rate close to the maximum channel capacity. According to the Shannon theorem, for a given bandwidth and signal-to-noisy ratio, the theoretical maximum channel capacity (reliable information transfer rate) for a particular noise level is defined by the following equation:

$$C = B \log_2(1 + \frac{S}{N}).$$

[0061] For any information transmission rate R < C, there exists an encoding scheme that would allow the probability of errors at the receiver to be made less than a pre-defined value ε. The channel encoding function 430 can select and/or implement an encoding scheme for a pre-defined value of ε.

[0062] In a further aspect, the multiplexing function 440 can be employed to combine multiple signals or data streams into one signal transmitted over a shared physical transmission medium (wireless channel). The multiplexing function 440 can implement one or more of the multiplexing technologies including TDMA (Time division multiple access), FDMA (Frequency division multiple access), CDMA (Code division multiple access), CSMA (Carrier sense multiple access), etc.

[0063] In a further aspect, the frequency spreading function 460 can implement one or more of the following technologies: DSSS (Direct Sequence Spread Spectrum), FHSS (Frequency Hopping Spread Spectrum), and OFDM (Orthogonal Frequency Division Multiplexing).

[0064] In a further aspect, the media access control function 470 can provide addressing and channel access control mechanisms.

[0065] In another aspect, the RF front end 340 can output to the ADC 350 an analog signal representative of a signal received over the wireless medium. The ADC 350 can output a digital signal representative of the analog signal outputted by the RF front end 340. The microprocessor 310 can execute a base-band decoder software program which can input the digital signal outputted by the ADC 350 and can decode the digital signal into a form suitable for further processing by other software programs.

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[0066] In a further aspect, the base-band decoder software program 500 can perform at least at least one of the following functions schematically shown in Fig. 5: media access control 510, frequency de-spreading 520, de-modulation 530, de-multiplexing 540 the analog signal, channel decoding 560, decryption 570, and source decoding 580. In one embodiment, the remaining functions (*i.e.*, those not implemented by the base-band decoder software program) can be implemented by one or more dedicated hardware components.

[0067] In one aspect, each of the frequency de-spreading 520, de-modulation 530, de-multiplexing 540, channel decoding 560, decryption 570, and source decoding 580 functions can be implemented as a reverse function of the frequency spreading 460, modulation 450, multiplexing 440, channel encoding 430, encryption 420, source encoding 410 functions, respectively.

[0068] In another aspect, the base-band encoder software program can be implemented as two or more software programs. In another aspect, the base-band decoder software program can be implemented as two or more software programs. In a further aspect, the base-band encoder software program and the base-band decoder software program can be implemented as a single software program.

[0069] In another aspect, due to advantageously performing at least some of the source bit stream encoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control.

[0070] In another aspect, due to advantageously performing at least some of the analog signal decoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0071] In a further aspect, the EIR terminal 100 can be configured to dynamically select a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol (*e.g.*, frequency or transmission power) to be used by the RF front end 340.

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[0072] Due to its ability to dynamically select a wireless communication network and a wireless communication protocol, the EIR terminal 100 according to the present invention can be advantageously used, *e.g.*, by a company operating in several geographies with different wireless communication standards. Using the EIR terminal 100 according to the present invention would allow such a company to deploy the same EIR terminal 100 model in all the geographies.

[0073] In one embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of a wireless communication protocol can be performed manually by the user of the EIR terminal 100. In one embodiment, the selection can be performed by scanning a pre-defined bar code. In another embodiment, the selection can be performed by the user interacting with the user interface (*e.g.*, via a graphical user interface (GUI), or via a hardware-implemented control). A skilled artisan would appreciate the fact that other methods of manually selecting a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol are within the scope and the spirit of the invention.

[0074] In another embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol can be performed by a wireless communication protocol selector software program executed by the EIR terminal 100. The wireless communication protocol selector software program can optimize a value of a user-defined criterion.

[0075] In one embodiment, the value of the user-defined criterion can be calculated based on one or more of the following parameters: frequency range, network status, signal strength, service cost, communication channel throughput, and user preferences. The user preferences can be represented, *e.g.*, by network preference, service preference, protocol preference, or frequency preference. A skilled artisan would appreciate the fact that other types of user preferences are within the spirit and the scope of the invention.

[0076] In one embodiment, the value of the user-defined criterion can be calculated as a weighted sum of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). In another embodiment, the value

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of the user-defined criterion can be calculated as a square root of a weighted sum of squares of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). A skilled artisan would appreciate the fact that other methods of calculating the user-defined criterion value are within the scope and spirit of the invention.

[0077] For example, if a user is more concerned about the cost than about other communication parameters, the user would want the user-defined criterion to yield the cheapest covered service provider (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or network selection). In another example, if a user is more concerned about the signal quality than about other communication parameters, the user would want the user-defined criterion to yield the network with best quality (while the cost can be a secondary factor affecting the service provider and/or network selection). In a yet another example, if a user is more concerned about maintaining uninterrupted communication session than about other communication parameters, the user would want the user-defined criterion to yield the network with best connection reliability (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or network selection). A skilled artisan would appreciate the fact that other methods of defining the user-defined criterion are within the scope and the spirit of the invention.

[0078] In one embodiment, the EIR terminal 100 can be configured to search beacon signals over a pre-defined frequency range (*e.g.*, between 800MHz and 5GHz), and then select a wireless communication network and/or frequency channel which would produce the optimal value of the user-defined criterion.

[0079] In one embodiment, the value of the user-defined criterion can be calculated immediately before the EIR terminal 100 attempts to initiate a communication session, so that a wireless communication network and/or a wireless communication protocol can be chosen which would optimize the user-defined criterion.

[0080] In another embodiment, the value of the user-defined criterion can be calculated periodically at established time intervals so that the EIR terminal 100 can change the wireless

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communication network and/or the wireless communication protocol between communication sessions or during a communication session if a wireless communication network and/or a wireless communication protocol is detected yielding a value of the user-defined criterion which is closer to the optimum than that of the current network or protocol. In yet another embodiment, the value of a user-defined criterion can be calculated responsive to a pre-defined event (*e.g.*, the signal quality falling below a pre-defined level, or the signal quality exceeding a pre-defined threshold), so that the EIR terminal 100 can automatically (*i.e.*, without user intervention) change the wireless communication network and/or the wireless communication protocol between communication sessions or during a communication session. Thus, the EIR terminal 100 can always maintain a network connection irrespectively of changing external conditions (*e.g.*, when the terminal is physically moved).

[0081] Form factors and housings for the EIR terminal 100 according to the invention are now being described. The components of EIR terminal 100 can be incorporated into a variety of different housings. As indicated by the embodiment of Figs. 6a and 6b, the components of Fig. 5 can be incorporated into a hand held housing 101. EIR terminal 100 of Figs. 6a and 6b is in the form factor of a hand held portable data terminal. EIR terminal 100 as shown in Figs. 6a and 6b includes a keyboard 1090, a display 504 having an associated touch screen overlay, a card reader 1348, and an imaging module 360 which includes the components of imaging assembly as described herein; namely, image sensor array incorporated on an image sensor IC chip. Imaging module 360 has an associated imaging axis, a_i. As indicated by the side view of Fig. 6b, the components of the block diagram of Fig. 5 may be supported within housing 101 on a plurality of circuit boards 1077. Imaging module 360 may include an image sensor array having color sensitive pixels as described in U. S. Provisional Patent Application Nos. 60/687,606, filed June 3, 2005, 60/690,268, filed June 14, 2005, 60/692,890, filed June 22, 2005, and 60/694,371, filed June 27, 2005, all of which are entitled Digital Picture Taking Optical Reader Having Hybrid Monochrome And Color Image Sensor, and all of which are incorporated herein by reference.

[0082] In the embodiment of Figs. 7a-7c, the EIR terminal 100 is in the form of a transaction terminal which may be configured as a retail purchase transaction terminal or as a price verifier. Housing 102 of the transaction terminal shown in Figs. 7a-7c is configured to

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be portable so that it can be moved from location to location and is further configured to be replaceably mounted on a fixed structure such as a fixed structure of a cashier station or a fixed structure of the retail store floor (*e.g.*, a shelf, a column 264 best viewed in Fig. 8b). Referring to bottom view of Fig. 7c, the housing 102 of the EIR terminal 100 has formations 268 facilitating the replaceable mounting of EIR terminal 100 on a fixed structure. Referring now to Fig. 7b, EIR terminal 100 includes a display 504 having an associated touch screen 504T, a card reader 1348, an imaging module 360, and a luminous shroud 362. When light from the illumination block (not shown in Fig. 8) strikes luminous shroud 362, the shroud glows to attract attention to the location of imaging assembly. In certain operating modes as indicated in Fig. 8c, the EIR terminal 100 in accordance with any of Figs. 7a-7c, displays on display 504 a PIN entry screen prompting a customer to enter PIN information into touch screen 504T. In other operating modes, as indicated in Fig. 8d, the EIR terminal 100 displays on display 504 a signature prompt screen prompting a customer to enter signature information into the device with use of a stylus 505.

[0083] Referring to Figs. 8a and 8b, various installation configurations for the EIR terminal of Figs. 7a-7c are shown. In the view of Fig. 8a, the EIR terminal 100 is installed as a retail purchase transaction terminal at a point of sale cashier station. In the setup of Fig. 8a, the EIR terminal 100 is configured as a retail purchase transaction terminal and is utilized to aid and facilitate retail transactions at a point of sale. A customer may enter a credit card or a debit card into card reader 1348 and retail purchase transaction terminal may transmit the credit card information to credit/debit authorization network.

[0084] In the view of Fig. 8b, the EIR terminal 100 is configured as a price verifier to aid customers in checking prices of products located on a store floor. EIR terminal 100 may be mounted on a shelf (not shown in Fig. 8b) or on a column 254 or other fixed structure of the retail store. EIR terminal 100 may decode bar code data from bar codes on store products and transmit decoded out bar code messages to a store server for lookup of price information which is sent back from the store server to terminal 100 for display on display 504.

[0085] While the present invention has been particularly shown and described with reference to certain exemplary embodiments, it will be understood by one skilled in the art that various changes in detail may be affected therein without departing from the spirit and scope of the invention as defined by claims that can be supported by the written description

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and drawings. Further, where exemplary embodiments are described with reference to a certain number of elements it will be understood that the exemplary embodiments can be practiced utilizing less than the certain number of elements.

[0086] A small sample of systems methods and apparatus that are described herein is as follows:

A1. An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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A2. The EIR terminal of claim A1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

A3. The EIR terminal of claim A1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

A4. The EIR terminal of claim A1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A5. The EIR terminal of claim A1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A6. The EIR terminal of claim A1 further comprising a central processing unit (CPU); wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

A7. The EIR terminal of claim A1 further comprising a central processing unit (CPU); wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

A8. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

A9. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at

least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A10. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A11. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of a network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

A12. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at

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least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A13. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A14. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

A15. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

A16. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program

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configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

A17. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

A18. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to periodically evaluate said user-defined criterion.

A19. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

A20. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

B1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

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a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

B2. The EIR terminal of claim B1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

B3. The EIR terminal of claim B1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B4. The EIR terminal of claim B1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B5. The EIR terminal of claim B1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

B6. The EIR terminal of claim B1 further comprising a central processing unit (CPU);

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wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

B7. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B8. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B9. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

B10. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B11. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B12. The EIR terminal of claim B1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

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B13. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

B14. The EIR terminal of claim B1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

B15. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

B16. The EIR terminal of claim B1 further configured to periodically evaluate said user-defined criterion.

B17. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

B18. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

C1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

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wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

C2. The EIR terminal of claim C1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C3. The EIR terminal of claim C1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C4. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

C5. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

D1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically

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select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

D2. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

D3. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using two or more chipsets.

D4. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D5. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D6. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

D7. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D8. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

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D9. The EIR terminal of claim D1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

D10. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

D11. The EIR terminal of claim D1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

D12. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

D13. The EIR terminal of claim D1 further configured to periodically evaluate said user-defined criterion.

D14. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

D15. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

E1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

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a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

E2. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

E3. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using two or more chipsets.

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WE CLAIM

1. An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

2. The EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation,

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frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

3. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

4. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

5. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

6. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

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wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

7. The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

8. The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

9. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

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10. The EIR terminal of claim 9, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

11. The EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

12. The EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

13. The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

14. The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

15. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

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wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

16. The EIR terminal of claim 15, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

17. The EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

18. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

19. The EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

20. The EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets.

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21. The EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

22. The EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

23. The EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

24. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

25. The EIR terminal of claim 24, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

26. The EIR terminal of claim 24, wherein said wireless communication interface is implemented using two or more chipsets.

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ABSTRACT

An encoded information reading (EIR) terminal can comprise a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface. The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message. The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus. The microprocessor can be configured to execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream. The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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SUBSTITUTE SPECIFICATION

ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

FIELD OF THE INVENTION

[0001] The invention is generally related to encoded information reading (EIR) terminals and is specifically related to an EIR terminal comprising a multi-protocol wireless communication interface.

BACKGROUND OF THE INVENTION

[0002] Encoded information reading (EIR) terminals equipped with wireless communication interfaces are widely used in retail stores, shipping facilities, etc. While wireless communication of EIR terminals offers many advantages as compared to wired communications, traditional wireless communication interfaces have noticeable shortcomings, *e.g.*, by failing to support more than one communication protocol and/or standard.

[0003] Accordingly, there is a need for further advances in EIR terminals and systems which would support multiple communication protocols and standards.

SUMMARY OF THE INVENTION

[0004] In one embodiment, there is provided an encoded information reading (EIR) terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0005] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

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[0006] The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0007] The microprocessor can be configured to execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream.

[0008] The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0009] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0010] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0011] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be

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electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0012] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0013] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0014] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0015] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0016] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

[0017] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0018] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be

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configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0019] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0020] In a further embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0021] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0022] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

[0023] An encoded information reading (EIR) terminal can comprise a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface. The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message. The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus. The microprocessor can be configured to

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execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream. The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] For the purpose of illustrating the invention, the drawings show aspects of one or more embodiments of the invention. However, it should be understood that the present invention is not limited to the precise arrangements and instrumentalities shown in the drawings, wherein:

[0025] Fig. 1 depicts a network level layout of a data collection system employing EIR terminal according to the invention;

[0026] Fig. 2 depicts a functional layout of a wireless communication interface;

[0027] Fig. 3 depicts a component level layout of an EIR terminal according to the invention;

[0028] Fig. 4 illustrates the functions of the base-band encoder software program according to the invention;

[0029] Fig. 5 illustrates the functions of the base-band encoder software program according to the invention;

[0030] Figs. 6a and 6b illustrate an exemplary hand held EIR terminal housing;

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[0031] Figs. 7a-7c illustrate an exemplary portable and remountable EIR terminal housing;

[0032] Fig. 8a illustrates a first exemplary deployment of an EIR terminal according to the invention within a retail store;

[0033] Fig. 8b illustrates a second exemplary deployment of an EIR terminal according to the invention within a retail store;

[0034] Figs. 8c and 8d illustrate PIN and signature data entry operational modes of an EIR terminal according to the invention.

[0035] The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the drawings, like numerals are used to indicate like parts throughout the various views.

DETAILED DESCRIPTION OF THE INVENTION

[0036] There is provided an encoded information reading (EIR) terminal for incorporation in a data collection system. The data collection system, schematically shown in Fig. 1, can include a plurality of EIR terminals 100a-100z in communication with a plurality of interconnected networks 110a-110z. In one aspect, the plurality of networks 110a-110z can include at least one IEEE 802.11 conformant wireless network. In another aspect, an EIR terminal 100a can be in communication with at least one wireless device over Bluetooth ™ wireless communication protocol. In a further aspect, the plurality of networks 110a-110z can include at least one GSM wireless network. In a further aspect, the plurality of networks 110a-110z can include at least one CDMA wireless network. Still further, the plurality of networks 110a-110z can include at least one 3G wireless network, *e.g.,* UMTS, HSUPA/HSDPA, or CDMA2000EvDO. In another aspect, the plurality of networks 110a-110z can include at least one 4G wireless network, *e.g.,* LTE, UWB, or 802.16m (WiMax). A skilled artisan would appreciate the fact that wireless networks implementing other wireless communication protocols are within the spirit and the scope of the invention.

[0037] In one aspect, an EIR terminal can comprise a wireless communication interface. The EIR terminal 100c can establish a communication session with the host computer 171. In one embodiment, network frames can be exchanged by the EIR terminal 100c and the host

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computer 171 via one or more routers, base stations, and other infrastructure elements. In another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a local area network (LAN). In a yet another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a wide area network (WAN). A skilled artisan would appreciate the fact that other methods of providing interconnectivity between the EIR terminal 100c and the host computer 171 relying upon LANs, WANs, virtual private networks (VPNs), and/or other types of network are within the spirit and the scope of the invention.

[0038] In a further aspect, the wireless communication interface can be configured to support at least two wireless communication protocols. In one embodiment, the wireless communication interface can be configured to support HSPA/GSM/GPRS/EDGE protocol family and CDMA/EV-DO protocol family. A skilled artisan would appreciate the fact that wireless communication interfaces supporting other communication protocols are within the spirit and the scope of the invention.

[0039] In one embodiment, the communications between the EIR terminal 100c and the host computer 171 can comprise a series of HTTP requests and responses transmitted over one or more TCP connections, although a person skilled in the art would appreciate the fact that using other transport and application level protocols is within the scope and the spirit of the invention.

[0040] In one aspect, at least one of the messages transmitted by the EIR terminal can include decoded message data corresponding to, *e.g.*, a bar code label or an RFID label attached to a product or to a shipment item. For example, an EIR terminal can transmit a request to the host computer to retrieve product information corresponding to a product identifier encoded by a bar code label attached to the product, or to transmit an item tracking record for an item identified by a bar code label attached to the product.

[0041] A wireless communication interface 210 best viewed in Fig. 2, can comprise a transmitter circuit 220 electrically coupled to a data source 221. The transmitter circuit 220 can be implemented by one or more specialized microchips, and can perform the following functions: source encoding 223, encryption 226, channel encoding 229, multiplexing 232, modulation 235, and frequency spreading 238.

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[0042] The wireless communication interface 210 of Fig. 2 can further comprise a receiver circuit 250 electrically coupled to the data sink 271. The receiver circuit 250 can be implemented by one or more specialized microchips, and can perform the following functions: frequency de-spreading 253, demodulation 256, de-multiplexing 259, channel decoding 262, decryption 265, and source decoding 268.

[0043] Each of the transmitter circuit 220 and receiver circuit 250 can be electrically coupled to a radio frequency (RF) front end 299. The RF front end 299 can be used to convert high frequency RF signals to/from base-band or intermediate frequency signals. A skilled artisan would appreciate the fact that RF front ends of different data rates, sensitivities, output powers, operating frequencies, and measurement resolutions are within the scope and spirit of the invention.

[0044] On the receiving side, the RF front-end 299 can include all filters, low-noise amplifiers (LNAs), and down-conversion mixer(s) needed to process modulated RF signals received by the antenna into based-band signals. In one embodiment, the receiving part of the RF front end 299 can comprise one or more of the following components:

- a first matching circuit to transfer to the next stage the energy received by the antenna;
- a band-pass filter (BPF) to knock down out-of-band jammers;
- a second matching circuit at the input of a low-noise amplifier (LNA);
- the LNA, the primary responsibility of which is to set the sensitivity of the receiver, by providing a high gain;
- a third matching circuit between the LNA output and the receive (RX) mixer (down-converter);
- the down-conversion RX mixer.

[0045] On the transmitting side, the RF frond-end area can be described as a "mirrored" version of a receiver. The front end of a transmitter up converts an outgoing base-band signal and then feeds the signal to a high power amplifier. A skilled artisan would appreciate the

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fact that other ways of implementing the RF front end are within the spirit and the scope of the invention.

[0046] According to one embodiment of the invention, the wireless communication interface supporting at least two wireless communication protocols can be implemented using a single dual-protocol (or multi-protocol) chipset. The chipset can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0047] In another embodiment, the wireless communication interface supporting at least two wireless communication protocols can be implemented using two or more chipsets. Each of the chipsets can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0048] In a yet another embodiment, at least some of the functions of the transmitter circuit and the receiver circuit can be advantageously performed by one or more software programs executed by a microprocessor. In one embodiment the EIR terminal 100 can comprise at least one microprocessor 310 and a memory 320, both coupled to the system bus 370, as best viewed in Fig. 3.

[0049] The microprocessor 310 can be provided by a general purpose microprocessor or by a specialized microprocessor (*e.g.*, an ASIC). In one embodiment, the EIR terminal 100 can comprise a single microprocessor which can be referred to as a central processing unit (CPU) and which can perform at least some of the functions of the transmitter circuit and the receiver circuit. In another embodiment, the EIR terminal 100 can comprise two or more microprocessors; for example, a CPU providing some or most of the EIR functionality and a specialized microprocessor performing some of the functions of the transmitter circuit and the receiver circuit. A skilled artisan would appreciate the fact that different schemes of processing tasks distribution among the two or more microprocessors are within the spirit and the scope of the invention.

[0050] The EIR terminal 100 can further comprise one or more encoded information reading (EIR) devices 330, including a bar code reading device, an RFID reading device, and a card reading device, also coupled to the system bus 370. In one embodiment, an EIR reading device can be capable of outputting decoded message data corresponding to an

encoded message. In another embodiment, the EIR reading device can output raw message data containing an encoded message, *e.g.*, raw image data or raw RFID data.

[0051] Of course, devices that read bar codes, read RFID, or read cards bearing encoded information may read more than one of these categories while remaining within the scope of the invention. For example, a device that reads bar codes may include a card reader, and/or RFID reader; a device that reads RFID may also be able to read bar codes and/or cards; and a device that reads cards may be able to also read bar codes and/or RFID. For further clarity, it is not necessary that a device's primary function involve any of these functions in order to be considered such a device; for example, a cellular telephone, smartphone, or PDA that is capable of reading bar codes is a device that reads bar codes for purposes of the present invention

[0052] The EIR terminal 100 can further comprise a keyboard interface 354 and a display adapter 355, both also coupled to the system bus 370. The EIR terminal 100 can further comprise a battery 356.

[0053] In a further aspect, the EIR terminal 100 can further comprise an RF front end 340. In a further aspect, the EIR terminal 100 can further comprise an analog-to-digital (ADC) converter 350, the input of which can be electrically coupled to the RF front end 340. The choice of ADC can be determined by the receiver architecture, and can depend upon the selectivity of the filters, the dynamic range afforded by the front-end amplifiers, and the bandwidth and type of modulation to be processed. For example, the level or dynamic range of signals expected to be presented to the ADC will dictate the bit resolution needed for the converter. An ADC can also be specified in terms of its spurious-free dynamic range (SFDR). The ADC's sensitivity can be influenced by wideband noise, including spurious noise, and can be improved through the use of an anti-aliasing filter at the input of the ADC to eliminate sampling of noise and high-frequency spurious products. To avoid aliasing when converting analog signals to the digital domain, the ADC sampling frequency must be at least twice the maximum frequency of the input analog signal. This minimum sampling condition derived from Nyquist's theorem, must be met in order to capture enough information about the input analog waveform to reconstruct it accurately. In addition to selecting an ADC for IF or baseband sampling, the choice of buffer amplifier to feed the input of the converter can affect the performance possible with a given sampling scheme. The buffer amplifier should

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provide the rise/fall time and transient response to preserve the modulation information of the IF or base-band signals, while also providing the good amplitude accuracy and flatness needed to provide signal amplitudes at an optimum input level to the ADC for sampling.

[0054] In another embodiment, the EIR terminal 100 can further comprise a digital-to-analog (DAC) converter 360, the output of which can be electrically coupled to the RF front end 340. In a further aspect, a DAC can be viewed as a component providing a function reversed to that of an ADC.

[0055] In a further aspect, the output of the ADC 350, and the input of the DAC 360 can be electrically coupled to a system bus 370. A skilled artisan would appreciate the fact that other microprocessors, memory, and/or peripheral devices can be electrically coupled to the system bus 370 without departing from the scope and the spirit of the invention.

[0056] In another aspect, the microprocessor 310 can execute a base-band encoder software program which can encode a bit stream which needs to be transmitted over a wireless medium. The encoded bit stream outputted by the base-band encoder software program can be fed to the input of the DAC 360. The analog signal representative of the encoded bit stream can be outputted by the DAC 360 to the RF front end 340 in order to be transmitted over a wireless medium.

[0057] In one embodiment, the base-band encoder software program 400 can perform at least one of the following functions schematically shown in Fig. 4: source encoding 410 of a bit stream 405, encryption 420, channel encoding 430, multiplexing 440, modulation 450, frequency spreading 460, and media access control 470. In one embodiment, the remaining functions (*i.e.,* those not implemented by the base-band encoder software program) can be implemented by one or more dedicated hardware components.

[0058] In one aspect, the source encoding function 410 can be provided by a process of encoding information using a different number of bits (or other information bearing units) than an un-encoded representation would use, through use of specific encoding schemes.

[0059] In another aspect, the encryption function 420 can be implemented by using an algorithm (cipher) suitable to transform an unencrypted ("plain text") information stream to an encrypted information stream.

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[0060] In a further aspect, the channel encoding function 430 can be provided by a process suitable to encode the transmitted information stream into a form, which would allow guaranteed reliable information transmission at a rate close to the maximum channel capacity. According to the Shannon theorem, for a given bandwidth and signal-to-noisy ratio, the theoretical maximum channel capacity (reliable information transfer rate) for a particular noise level is defined by the following equation:

$$C = B \log_2(1 + \frac{S}{N}).$$

[0061] For any information transmission rate R < C, there exists an encoding scheme that would allow the probability of errors at the receiver to be made less than a pre-defined value ε. The channel encoding function 430 can select and/or implement an encoding scheme for a pre-defined value of ε.

[0062] In a further aspect, the multiplexing function 440 can be employed to combine multiple signals or data streams into one signal transmitted over a shared physical transmission medium (wireless channel). The multiplexing function 440 can implement one or more of the multiplexing technologies including TDMA (Time division multiple access), FDMA (Frequency division multiple access), CDMA (Code division multiple access), CSMA (Carrier sense multiple access), etc.

[0063] In a further aspect, the frequency spreading function 460 can implement one or more of the following technologies: DSSS (Direct Sequence Spread Spectrum), FHSS (Frequency Hopping Spread Spectrum), and OFDM (Orthogonal Frequency Division Multiplexing).

[0064] In a further aspect, the media access control function 470 can provide addressing and channel access control mechanisms.

[0065] In another aspect, the RF front end 340 can output to the ADC 350 an analog signal representative of a signal received over the wireless medium. The ADC 350 can output a digital signal representative of the analog signal outputted by the RF front end 340. The microprocessor 310 can execute a base-band decoder software program which can input the digital signal outputted by the ADC 350 and can decode the digital signal into a form suitable for further processing by other software programs.

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[0066] In a further aspect, the base-band decoder software program 500 can perform at least at least one of the following functions schematically shown in Fig. 5: media access control 510, frequency de-spreading 520, de-modulation 530, de-multiplexing 540 the analog signal, channel decoding 560, decryption 570, and source decoding 580. In one embodiment, the remaining functions (*i.e.*, those not implemented by the base-band decoder software program) can be implemented by one or more dedicated hardware components.

[0067] In one aspect, each of the frequency de-spreading 520, de-modulation 530, de-multiplexing 540, channel decoding 560, decryption 570, and source decoding 580 functions can be implemented as a reverse function of the frequency spreading 460, modulation 450, multiplexing 440, channel encoding 430, encryption 420, source encoding 410 functions, respectively.

[0068] In another aspect, the base-band encoder software program can be implemented as two or more software programs. In another aspect, the base-band decoder software program can be implemented as two or more software programs. In a further aspect, the base-band encoder software program and the base-band decoder software program can be implemented as a single software program.

[0069] In another aspect, due to advantageously performing at least some of the source bit stream encoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control.

[0070] In another aspect, due to advantageously performing at least some of the analog signal decoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0071] In a further aspect, the EIR terminal 100 can be configured to dynamically select a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol (*e.g.*, frequency or transmission power) to be used by the RF front end 340.

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[0072] Due to its ability to dynamically select a wireless communication network and a wireless communication protocol, the EIR terminal 100 according to the present invention can be advantageously used, *e.g.*, by a company operating in several geographies with different wireless communication standards. Using the EIR terminal 100 according to the present invention would allow such a company to deploy the same EIR terminal 100 model in all the geographies.

[0073] In one embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of a wireless communication protocol can be performed manually by the user of the EIR terminal 100. In one embodiment, the selection can be performed by scanning a pre-defined bar code. In another embodiment, the selection can be performed by the user interacting with the user interface (*e.g.*, via a graphical user interface (GUI), or via a hardware-implemented control). A skilled artisan would appreciate the fact that other methods of manually selecting a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol are within the scope and the spirit of the invention.

[0074] In another embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol can be performed by a wireless communication protocol selector software program executed by the EIR terminal 100. The wireless communication protocol selector software program can optimize a value of a user-defined criterion.

[0075] In one embodiment, the value of the user-defined criterion can be calculated based on one or more of the following parameters: frequency range, network status, signal strength, service cost, communication channel throughput, and user preferences. The user preferences can be represented, *e.g.*, by network preference, service preference, protocol preference, or frequency preference. A skilled artisan would appreciate the fact that other types of user preferences are within the spirit and the scope of the invention.

[0076] In one embodiment, the value of the user-defined criterion can be calculated as a weighted sum of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). In another embodiment, the value

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of the user-defined criterion can be calculated as a square root of a weighted sum of squares of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). A skilled artisan would appreciate the fact that other methods of calculating the user-defined criterion value are within the scope and spirit of the invention.

[0077] For example, if a user is more concerned about the cost than about other communication parameters, the user would want the user-defined criterion to yield the cheapest covered service provider (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or network selection). In another example, if a user is more concerned about the signal quality than about other communication parameters, the user would want the user-defined criterion to yield the network with best quality (while the cost can be a secondary factor affecting the service provider and/or network selection). In a yet another example, if a user is more concerned about maintaining uninterrupted communication session than about other communication parameters, the user would want the user-defined criterion to yield the network with best connection reliability (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or network selection). A skilled artisan would appreciate the fact that other methods of defining the user-defined criterion are within the scope and the spirit of the invention.

[0078] In one embodiment, the EIR terminal 100 can be configured to search beacon signals over a pre-defined frequency range (*e.g.*, between 800MHz and 5GHz), and then select a wireless communication network and/or frequency channel which would produce the optimal value of the user-defined criterion.

[0079] In one embodiment, the value of the user-defined criterion can be calculated immediately before the EIR terminal 100 attempts to initiate a communication session, so that a wireless communication network and/or a wireless communication protocol can be chosen which would optimize the user-defined criterion.

[0080] In another embodiment, the value of the user-defined criterion can be calculated periodically at established time intervals so that the EIR terminal 100 can change the wireless

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communication network and/or the wireless communication protocol between communication sessions or during a communication session if a wireless communication network and/or a wireless communication protocol is detected yielding a value of the user-defined criterion which is closer to the optimum than that of the current network or protocol. In yet another embodiment, the value of a user-defined criterion can be calculated responsive to a pre-defined event (*e.g.*, the signal quality falling below a pre-defined level, or the signal quality exceeding a pre-defined threshold), so that the EIR terminal 100 can automatically (*i.e.*, without user intervention) change the wireless communication network and/or the wireless communication protocol between communication sessions or during a communication session. Thus, the EIR terminal 100 can always maintain a network connection irrespectively of changing external conditions (*e.g.*, when the terminal is physically moved).

[0081] Form factors and housings for the EIR terminal 100 according to the invention are now being described. The components of EIR terminal 100 can be incorporated into a variety of different housings. As indicated by the embodiment of Figs. 6a and 6b, the components of Fig. 5 can be incorporated into a hand held housing 101. EIR terminal 100 of Figs. 6a and 6b is in the form factor of a hand held portable data terminal. EIR terminal 100 as shown in Figs. 6a and 6b includes a keyboard 1090, a display 504 having an associated touch screen overlay, a card reader 1348, and an imaging module 360 which includes the components of imaging assembly as described herein; namely, image sensor array incorporated on an image sensor IC chip. Imaging module 360 has an associated imaging axis, a_i. As indicated by the side view of Fig. 6b, the components of the block diagram of Fig. 5 may be supported within housing 101 on a plurality of circuit boards 1077. Imaging module 360 may include an image sensor array having color sensitive pixels as described in U. S. Provisional Patent Application Nos. 60/687,606, filed June 3, 2005, 60/690,268, filed June 14, 2005, 60/692,890, filed June 22, 2005, and 60/694,371, filed June 27, 2005, all of which are entitled Digital Picture Taking Optical Reader Having Hybrid Monochrome And Color Image Sensor, and all of which are incorporated herein by reference.

[0082] In the embodiment of Figs. 7a-7c, the EIR terminal 100 is in the form of a transaction terminal which may be configured as a retail purchase transaction terminal or as a price verifier. Housing 102 of the transaction terminal shown in Figs. 7a-7c is configured to

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be portable so that it can be moved from location to location and is further configured to be replaceably mounted on a fixed structure such as a fixed structure of a cashier station or a fixed structure of the retail store floor (*e.g.*, a shelf, a column 264 best viewed in Fig. 8b). Referring to bottom view of Fig. 7c, the housing 102 of the EIR terminal 100 has formations 268 facilitating the replaceable mounting of EIR terminal 100 on a fixed structure. Referring now to Fig. 7b, EIR terminal 100 includes a display 504 having an associated touch screen 504T, a card reader 1348, an imaging module 360, and a luminous shroud 362. When light from the illumination block (not shown in Fig. 8) strikes luminous shroud 362, the shroud glows to attract attention to the location of imaging assembly. In certain operating modes as indicated in Fig. 8c, the EIR terminal 100 in accordance with any of Figs. 7a-7c, displays on display 504 a PIN entry screen prompting a customer to enter PIN information into touch screen 504T. In other operating modes, as indicated in Fig. 8d, the EIR terminal 100 displays on display 504 a signature prompt screen prompting a customer to enter signature information into the device with use of a stylus 505.

[0083] Referring to Figs. 8a and 8b, various installation configurations for the EIR terminal of Figs. 7a-7c are shown. In the view of Fig. 8a, the EIR terminal 100 is installed as a retail purchase transaction terminal at a point of sale cashier station. In the setup of Fig. 8a, the EIR terminal 100 is configured as a retail purchase transaction terminal and is utilized to aid and facilitate retail transactions at a point of sale. A customer may enter a credit card or a debit card into card reader 1348 and retail purchase transaction terminal may transmit the credit card information to credit/debit authorization network.

[0084] In the view of Fig. 8b, the EIR terminal 100 is configured as a price verifier to aid customers in checking prices of products located on a store floor. EIR terminal 100 may be mounted on a shelf (not shown in Fig. 8b) or on a column 254 or other fixed structure of the retail store. EIR terminal 100 may decode bar code data from bar codes on store products and transmit decoded out bar code messages to a store server for lookup of price information which is sent back from the store server to terminal 100 for display on display 504.

[0085] While the present invention has been particularly shown and described with reference to certain exemplary embodiments, it will be understood by one skilled in the art that various changes in detail may be affected therein without departing from the spirit and scope of the invention as defined by claims that can be supported by the written description

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and drawings. Further, where exemplary embodiments are described with reference to a certain number of elements it will be understood that the exemplary embodiments can be practiced utilizing less than the certain number of elements.

[0086] A small sample of systems methods and apparatus that are described herein is as follows:

A1. An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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A2. The EIR terminal of claim A1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

A3. The EIR terminal of claim A1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

A4. The EIR terminal of claim A1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A5. The EIR terminal of claim A1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A6. The EIR terminal of claim A1 further comprising a central processing unit (CPU); wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

A7. The EIR terminal of claim A1 further comprising a central processing unit (CPU); wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

A8. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

A9. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at

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least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A10. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A11. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of a network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

A12. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at

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least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A13. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A14. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

A15. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

A16. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program

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configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

A17. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

A18. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to periodically evaluate said user-defined criterion.

A19. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

A20. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

B1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

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a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

B2. The EIR terminal of claim B1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

B3. The EIR terminal of claim B1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B4. The EIR terminal of claim B1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B5. The EIR terminal of claim B1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

B6. The EIR terminal of claim B1 further comprising a central processing unit (CPU);

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wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

B7. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B8. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B9. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

B10. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B11. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B12. The EIR terminal of claim B1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

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B13. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

B14. The EIR terminal of claim B1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

B15. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

B16. The EIR terminal of claim B1 further configured to periodically evaluate said user-defined criterion.

B17. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

B18. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

C1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

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wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

C2. The EIR terminal of claim C1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C3. The EIR terminal of claim C1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C4. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

C5. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

D1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically

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select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

D2. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

D3. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using two or more chipsets.

D4. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D5. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D6. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

D7. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D8. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

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D9. The EIR terminal of claim D1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

D10. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

D11. The EIR terminal of claim D1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

D12. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

D13. The EIR terminal of claim D1 further configured to periodically evaluate said user-defined criterion.

D14. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

D15. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

E1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

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a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

E2. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

E3. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using two or more chipsets.

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WE CLAIM

1. An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

2. The EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation,

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frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

3. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

4. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

5. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

6. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

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wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

7. The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

8. The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

9. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

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10. The EIR terminal of claim 9, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

11. The EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

12. The EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

13. The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

14. The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

15. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

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wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

16. The EIR terminal of claim 15, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

17. The EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

18. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

19. The EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

20. The EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets.

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21. The EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

22. The EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

23. The EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

24. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

25. The EIR terminal of claim 24, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

26. The EIR terminal of claim 24, wherein said wireless communication interface is implemented using two or more chipsets.

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ABSTRACT

An encoded information reading (EIR) terminal can comprise a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface. The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message. The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus. The microprocessor can be configured to execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream. The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Yajun P. Wang	H0022017	3751

TITLE OF INVENTION: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$230	$0	$1510	$230	02/09/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRECH, KARL D	2887	235-462250

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ART UNIT	PAPER NUMBER
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DATE MAILED: 11/09/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

TITLE OF INVENTION: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$230	$0	$1510	$230	02/09/2012

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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

93689 7590 11/09/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

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Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

TITLE OF INVENTION: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$230	$0	$1510	$230	02/09/2012

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRECH, KARL D	2887	235-462250

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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Exhibit 1023 (Page 121)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

93689 7590 11/09/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER	
FRECH, KARL D	

ART UNIT	PAPER NUMBER
2887	

DATE MAILED: 11/09/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 35 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 35 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

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Exhibit 1023 (Page 122)

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/567,158	WANG ET AL.	
	Examiner	Art Unit	
	KARL D. FRECH	2887	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the RCE filed 10/13/11*.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *1-23*.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 10/11
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

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1. Applicants RCE, IDS and amendment filed 10/13/11 have been entered. Claims 24-26 have been cancelled.

2. Claims 1-23 are allowed for the same reasons as previously set forth.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARL D. FRECH whose **EMAIL address is** karl.frech@uspto.gov. If attempts to reach the examiner by **EMAIL** are unsuccessful, the examiner's telephone number is (571)272-2390. The examiner can normally be reached on maxi-flex.

IFF ALL attempts to reach the examiner by **EMAIL** and telephone are unsuccessful, the examiner's supervisor, Steven Paik can be reached on (571) 272-2404. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

***
3.

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/567,158	WANG ET AL.	
	Examiner	Art Unit	
	KARL D. FRECH	2887	

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
235	462.25	235	462.44	472.01					
INTERNATIONAL CLASSIFICATION									
G 0 6 K	19/06								
	/								
	/								
	/								
	/								

---------- (Assistant Examiner) (Date)		Total Claims Allowed: 23
(Legal Instruments Examiner) (Date)	/Karl D. Frech/ 10/23/11 (Primary Examiner) (Date)	O.G. Print Claim(s): 1 / O.G. Print Fig.: 6a

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		31		61		91		121		151		181
2	2		32		62		92		122		152		182
3	3		33		63		93		123		153		183
4	4		34		64		94		124		154		184
5	5		35		65		95		125		155		185
6	6		36		66		96		126		156		186
7	7		37		67		97		127		157		187
8	8		38		68		98		128		158		188
9	9		39		69		99		129		159		189
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12	12		42		72		102		132		162		192
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	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

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Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
12/567,158	WANG ET AL.
Examiner	**Art Unit**
KARL D. FRECH	2887

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	10/23/11
1	1	=
2	2	=
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Claim		Date
Final	Original	
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Claim		Date
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 9

Complete if Known	
Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-7,908,420	03-15-2011	Rofougaran et al.	
	AB*	US-7,903,724	03-08-2011	Rofougaran et al.	
	AC*	US-7,899,394	03-01-2011	Rofougaran et al.	
	AD*	US-7,893,790	02-22-2011	Van Delden	
	AE*	US-7,885,600	02-08-2011	Rofougaran et al.	
	AF*	US-7,874,483-A1	01-25-2011	Wang et al.	
	AG*	US-7,835,157	11-16-2010	Tilmans et al.	
	AH*	US-7,809,329	10-05-2010	Rofougaran et al.	
	AI*	US-7,795,700	09-14-2010	Rofougaran et al.	
	AJ*	US-7,750,435	07-06-2010	Rofougaran et al.	
	AK*	US-7,696,929	04-13-2010	Kaneda	
	AL*	US-7,617,342	11-10-2009	Rofougaran	
	AM*	US-7,586,387	09-08-2009	Van Delden	
	AN*	US-7,466,274	12-16-2008	Lin et al.	
	AO*	US-7,446,717	11-04-2008	Hung et al.	
	AP*	US-7,423,599	09-09-2008	Li et al.	
	AQ*	US-7,368,311	05-06-2008	Tilmans et al.	
	AR*	US-7,333,067	02-19-2008	Hung et al.	
	AS*	US-7,307,331	12-11-2007	Kipnis et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	BA	WO-9814023-A1	04-02-1998	Advanced Micro Devices Inc		EN
	BB	EP-2061285-A2	05-20-2009	Hand Held Prod Inc		EN

Examiner Signature	/Karl Frech/	Date Considered	11/04/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

IDS (Citation) by Applicant (162 References)

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: October 13, 2011 Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.F./

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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 9

Complete if Known	
Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

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	AT*	US-7,283,094	10-16-2007	Lee	
	AU*	US-7,265,731	09-04-2007	Vance et al.	
	AV*	US-7,251,499	07-31-2007	Ella et al.	
	AW*	US-7,218,678	05-15-2007	Katta et al.	
	AX*	US-7,202,819	04-10-2007	Hatch	
	AY*	US-7,190,728	03-13-2007	Kawada et al.	
	AZ*	US-7,072,690	07-04-2006	Shin et al.	
	AA1*	US-6,961,544	11-01-2005	Hagstrom	
	AB1*	US-6,937,196	08-30-2005	Korva	
	AC1*	US-6,911,945	06-28-2005	Korva	
	AD1*	US-6,751,470	06-15-2004	Ella et al.	
	AE1*	US-6,167,099	12-26-2000	Rader et al.	
	AF1*	US-5,903,825	05-11-1999	Goode et al.	
	AG1*	US-5,812,605	09-22-1998	Smith et al.	
	AH1*	US-5,579,341	11-26-1996	Smith et al.	
	AI1*	US-20110066774	03-17-2011	Rofougaran et al.	
	AJ1*	US-20100285634	11-11-2010	ROFOUGARAN et al.	
	AK1*	US-20100276498	11-04-2010	Rofougaran et al.	
	AL1*	US-20100238075	09-23-2010	Pourseyed	

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Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	/Karl Frech/	Date Considered	11/04/2011

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 3 of 9

Complete if Known	
Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AM1*	US-20100232474	09-16-2010	Rofougaran et al.	
	AN1*	US-20100079347	04-01-2010	Hayes et al.	
	AO1*	US-20100077115	03-25-2010	Rofougaran et al.	
	AP1*	US-20100022195	01-28-2010	ROFOUGARAN et al.	
	AQ1*	US-20090323783	12-31-2009	Buris et al.	
	AR1*	US-20090285135	11-19-2009	Rousu et al.	
	AS1*	US-20090227205	09-10-2009	Rofougaran et al.	
	AT1*	US-20090218657	09-03-2009	Rofougaran et al.	
	AU1*	US-20090180403	07-16-2009	Tudosoiu	
	AV1*	US-20090167457	07-02-2009	Melde et al.	
	AW1*	US-20090148074	06-11-2009	XU et al.	
	AX1*	US-20090121951	05-14-2009	Kaneda	
	AY1*	US-20090115549	05-07-2009	Lee	
	AZ1*	US-20090074106	03-19-2009	See et al.	
	AA2*	US-20090067388	03-12-2009	van Rooyen et al.	
	AB2*	US-20090058734	03-05-2009	ALI et al.	
	AC2*	US-20090037627	02-05-2009	Rofougaran et al.	
	AD2*	US-20090036067	02-05-2009	Rofougaran et al.	
	AE2*	US-20090033359	02-05-2009	Rofougaran et al.	

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Sheet 4 of 9

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Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

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	AF2*	US-20090028082	01-29-2009	Wynn et al.	
	AG2*	US-20090024550	01-22-2009	Wynn et al.	
	AH2*	US-20090006677	01-01-2009	Rofougaran et al.	
	AI2*	US-20080297404	12-04-2008	Lin et al.	
	AJ2*	US-20080278370	11-13-2008	Lachner et al.	
	AK2*	US-20080182613	07-31-2008	Rofougaran et al.	
	AL2*	US-20080181287	07-31-2008	Rofougaran et al.	
	AM2*	US-20080181186	07-31-2008	Rofougaran et al.	
	AN2*	US-20080157897	07-03-2008	Tilmans et al.	
	AO2*	US-20080150829	06-26-2008	Lin et al.	
	AP2*	US-20080150807	06-26-2008	Lin et al.	
	AQ2*	US-20080107213	05-08-2008	Gupta et al.	
	AR2*	US-20070257847	11-08-2007	Su et al.	
	AS2*	US-20060279446	12-14-2006	Wang et al.	
	AT2*	US-20060135084	06-22-2006	Lee	
	AU2*	US-20060128332	06-15-2006	van Rooyen et al.	
	AV2*	US-20060025102	02-02-2006	Kipnis et al.	
	AW2*	US-20050271133	12-08-2005	Waxman	
	AX2*	US-20050156796	07-21-2005	Nysen	

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Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

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	AY2*	US-20050128152	06-16-2005	Milosavljevic	
	AZ2*	US-20040249915	12-09-2004	Russell	
	AA3*	US-20020183013	12-05-2002	Auckland et al.	
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	AE3*	US-7,161,357	01-09-2007	Lee et al.	
	AF3*	US-20110174877	07-21-2011	Fleck et al.	
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	AH3*	US-20110148586	06-23-2011	Anderson et al.	
	Ai3*	US-20110136457	06-09-2011	Yu	
	AJ3*	US-20110095950	04-28-2011	Yu	
	AK3*	US-20100127085	05-27-2010	Yamagajo et al.	
	AL3*	US-20090322490	12-31-2009	Kung et al.	
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	AR3*	US-20070060089	03-15-2007	Owen et al.	
	AS3*	US-20060261938	11-23-2006	Lai et al.	
	AT3*	US-20060261821	11-23-2006	Lee et al.	
	AU3*	US-20060070089	03-30-2006	Shoaib et al.	

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Complete if Known	
Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

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	AV3*	US-7,592,957	09-22-2009	Achour et al.	
	AW3*	US-7,764,232	07-27-2010	Achour et al.	
	AX3*	US-7,839,216	11-23-2010	Alidio et al.	
	AY3*	US-7,839,236	11-23-2010	Dupuy et al.	
	AZ3*	US-7,847,739	12-07-2010	Achour et al.	
	AA4*	US-7,855,696	12-21-2010	Gummalla et al.	
	AB4*	US-20080048917	02-28-2008	Maha et al.	
	AC4*	US-20080258981	10-23-2008	Maha et al.	
	AD4*	US-20080258993	10-23-2008	Gummalla et al.	
	AE4*	US-20090128446	05-21-2009	Gummalla et al.	
	AF4*	US-20090135087	05-28-2009	Gummalla et al.	
	AG4*	US-20090160575	06-25-2009	Dupuy et al.	
	AH4*	US-20090160578	06-25-2009	Maha Achour	
	AI4*	US-20090219213	09-03-2009	Lee et al.	
	AJ4*	US-20090245146	10-01-2009	Gummalla et al.	
	AK4*	US-20090251385	10-08-2009	Xu et al.	
	AL4*	US-20090289737	11-26-2009	Itoh et al.	
	AM4*	US-20090295473	12-03-2009	Dupuy et al.	
	AN4*	US-20090295483	12-03-2009	Alidio et al.	
	AO4*	US-20090295660	12-03-2009	Xu et al.	
	AP4*	US-20090316612	12-24-2009	Poilasne et al.	
	AQ4*	US-20100045554	02-25-2010	Xu et al.	
	AR4*	US-20100060544	03-11-2010	Penev et al.	
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Sheet 7 of 9

Complete if Known	
Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

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	AT4*	US-20100109805	05-06-2010	Maha Achour	
	AU4*	US-20100109971	05-06-2010	Gummalla et al.	
	AV4*	US-20100109972	05-06-2010	Xu et al.	
	AW4*	US-20100110943	05-06-2010	Gummalla et al.	
	AX4*	US-20100117908	05-13-2010	Lee et al.	
	AY4*	US-20100123635	05-20-2010	Lopez et al.	
	AZ4*	US-20100157858	06-24-2010	Lee et al.	
	AA5*	US-20100171563	07-08-2010	Dupuy et al.	
	AB5*	US-20100176880	07-15-2010	Dupuy et al.	
	AC5*	US-20100207703	08-19-2010	Dupuy et al.	
	AD5*	US-20100225554	09-09-2010	Huang et al.	
	AE5*	US-20100231464	09-16-2010	Huang et al.	
	AF5*	US-20100231470	09-16-2010	Lee et al.	
	AG5*	US-20100238081	09-23-2010	Achour et al.	
	AH5*	US-20100283692	11-11-2010	Achour et al.	
	AI5*	US-20100283705	11-11-2010	Achour et al.	
	AJ5*	US-20110026624	02-03-2011	Gummalla et al.	
	AK5*	US-20110039501	02-17-2011	Achour et al.	
	AL5*	US-20110050364	03-03-2011	Maha Achour	
	AM5*	US-20110068873	03-24-2011	Alidio et al.	
	AN5*	US-20110095964	04-28-2011	Pathak et al.	
	AO5*	US-20110109402	05-12-2011	Dupuy et al.	
	AP5*	US-4774715	09-27-1988	Messenger et al.	
	AQ5*	US-4825058	04-25-1989	Poland	

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First Named Inventor	Ynjiun P. Wang
Art Unit	2887
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	AR5*	US-4868375	09-19-1989	Blanford	
	AS5*	US-5101406	03-31-1992	Messenger et al.	
	AT5*	US-5256865	10-26-1993	Wike, Jr. et al.	
	AU5*	US-5347113	09-13-1994	Reddersen et al.	
	AV5*	US-5510606	04-23-1996	Worthington et al.	
	AW5*	US-5610595	03-11-1997	Garrabrant et al.	
	AX5*	US-5793903	08-11-1998	Lopresti et al.	
	AY5*	US-5802179	09-01-1998	Yamamoto et al.	
	AZ5*	US-5815811	09-29-1998	Pinard et al.	
	AA6*	US-5973681	10-26-1999	Tanigawa et al.	
	AB6*	US-6345764	02-12-2002	Knowles	
	AC6*	US-6384744	05-07-2002	Philyaw et al.	
	AD6*	US-6823388	11-23-2004	Philyaw et al.	
	AE6*	US-6908034	06-21-2005	Alleshouse	
	AF6*	US-7159214-B2	01-02-2007	Rajaram et al.	
	AG6*	US-20020066788	06-06-2002	Knowles	
	AH6*	US-7367514	05-06-2008	Soule et al.	
	AI6*	US-20080203167	08-28-2008	Soule et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 9 of 9

Complete if Known	
Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	CA	B.P. Otis, Y.H. Chee, R. Lu, N.M. Pletcher, J.M. Rabaey, "An Ultra-Low Power MEMS-Based Two-Channel Transceiver for Wireless Sensor Networks," (4 pages).	EN
	CB	C.T.- C Nguyen, "Vibrating RF MEMS for Low Power Communications (invited)," Proceedings, 2002 MRS Fall Meeting, Boston, Massachusetts, Dec. 2-6, 2002, pp. J12.1.1-J2.1.12 (12 pages).	EN
	CC	EUROPEAN PATENT OFFICE, European Patent Application Number 10191449.1, Communication Extended Search Report, dated February 21, 2011 (11 pages).	EN
	CD	EUROPEAN PATENT OFFICE, Partial European Search Report, European Patent Application Number: 10176444.7, dated February 11, 2011 (8 pages).	EN
	CE	HAWAII INTERNATIONAL CONFERENCE ON, IEEE, PISCATAWAY, NJ, USA, Dynamic Dispatching and Transport Optimization - Real- World Experience with Perspectives on Pervasive Technology Integration, dated January 5, 2009 (9 pages)	EN
	CF	S. Lee and C.T. -C Nguyen, "Influence of Automatic Level Control on Micromechanical Resonator Oscsillator Phase Noise," proceedings, 2003 IEEE Int. Frequency Control Symposium, Tampa, Florida, May 5-8, 2003, pp. 341-349. (9 pages).	EN
	CG	STATE INTELLECTUAL PROPERTY OFFICE, P.R. CHINA, Notice of Amendment, Chinese Application No. 201010544113.X, Dated December 7, 2010, (2 pages).	EN
	CH	WWW.NANO.GATECH.EDU/NEWS/RELEASE.PHP, Georgia Institute of Technology: Nanoscience and Nanotechnology, "Researchers Win $3.5 Million to Improve Wireless," Website, August 5, 2010, (3 pages).	EN
	CI	U.S. Patent Application No. 12/621,914 filed with the United States Patent and Trademark Office November 19, 2009.	EN
	CJ	U.S. Patent Application No. 13/211,555 filed with the United States Patent and Trademark Office August 17, 2011 (41 pages).	EN
	CK	U.S. Patent Application No. 13/211,568, filed with the United States Patent and Trademark Office August 17, 2011 (35 pages).	EN
	CL	United States Patent Application No. 13/211,575, filed with the United States Patent and Trademark Office, August 17, 2011 (27 pages).	EN
	CM	EPC GLOBAL, Specification for RFID AIR Interface, dated January 31, 2005 (94 pages).	EN
	CN	EUROPEAN PATENT OFFICE, European Search Report, European Patent Application Number: 10176444.7, dated June 6, 2011 (5 pages).	EN
	CO	EUROPEAN PATENT OFFICE, Communication Pursuant to Article 94(3) EPC, European Patent Application Number: 10176444.7, dated July 5, 2011 (10 pages).	EN

Examiner Signature	/Karl Frech/	Date Considered	10/23/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.F./

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination
	12/567,158	WANG ET AL.
	Examiner	Art Unit
	KARL D. FRECH	2887

SEARCHED			
Class	Subclass	Date	Examiner
235	462.25 462.44 462.45 462.46 472.01	10/23/2011	KDF
235	472.02	10/23/2011	KDF
235	472.03	10/23/2011	KDF

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
same as	**above**	10/23/2011	**KDF**

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
search updated	10/23/2011	KDF

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Exhibit 1023 (Page 137)

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

PATENT WITHDRAWAL NOTICE

DATE WITHDRAWN	WITHDRAWAL NUMBER
10/14/2011	19952

The following application has been **WITHDRAWN** from the

10/18/2011 issue.

SERIAL NO.	PATENT NUMBER
12/567,158	8,038,065
DRAWINGS	**CLASS**
009	235/462

TITLE

ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

NAME AND ADDRESS

YNJIUN P. WANG, ET AL
CUPERTINO, CA

REASON FOR WITHDRAWAL

Office of Petitions granted applicant's request to withdraw patent from issue.

APPROVED

/Kimberly Terrell/, Manager

Patent Publication Branch
Office of Data Management

FORM PTO-302 -- (REV. 05-2009)

Petition to Withdraw Application From Issue (RCE)
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: October 13, 2011
Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 | Confirmation No.: 3751

Filed: September 25, 2009 | Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE | Examiner: Karl D. Frech

PETITION TO WITHDRAW APPLICATION FROM ISSUE PURSUANT TO 37 CFR §1.313(c)(2), 37 CFR §1.114, and 37 CFR §1.17(h)

MS Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The present petition is being filed to withdraw the above application from issue after payment of the issue fee to allow consideration of a Request for Continued Examination ("RCE") in compliance with *37 CFR §1.114*. An RCE is being filed concurrently herewith to allow consideration and entry of an Amendment and an Information Disclosure Statement ("IDS"), copies of which are enclosed.

Under *37 CFR §1.313(c)* a petition to withdraw an application from issue after payment of an issue fee should be granted under *37 CFR §1.313(c)* to allow consideration of an RCE under *37 CFR §1.114*.

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Exhibit 1023 (Page 139)

An issue fee in the present application was paid on September 8, 2011. When the present application is allowed again, the new Notice of Allowance will reflect an issue fee amount that is the difference between the current issue fee amount and the issue fee amount previously paid. *MPEP §706.07(h)(IX).*

If the Patent Petition Office believes that contact with applicants' attorney would be advantageous toward the disposition of this case, the Office is herein requested to call applicants' representative at the phone number listed below.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 08-1935.

Dated: October 13, 2011

GSB/nrp

Respectfully submitted,
Electronic signature: /George S. Blåsiak/
George S. Blasiak
Registration No.: 37,283
HESLIN ROTHENBERG
FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
(518) 452-5600
Customer No.: 93689

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Exhibit 1023 (Page 140)

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Date : October 14, 2011

TO : Director, Office of Data Management

FROM : Office of Petitions

SUBJECT : Withdrawal from Issue of **Application No. 12/567,158**

Applicant(s) : Ynjium P. Wang, et al.
Application No. : 12/567,158
Filed : September 25, 2009

The above-identified application has been assigned Patent No. 8,038,065 and an issue date of October 18, 2011.

It is hereby directed that this application be withdrawn from issue at the request of the applicant. Do not refund the issue fee.

The following erratum should be published in the Official Gazette if the above-identified application is published in the OG of October 18, 2011, 2010:

"All reference to Patent No. 8,038,065 to Ynjium P. Wang, et al. of California for ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE appearing in the Official Gazette of October 17, 2011 should be deleted since no patent was granted."

/Terri Johnson/
Terri Johnson
Petitions Examiner
Office of Petitions

cc: Paul Harrison
Deneise Boyd
Mary Louise McAskill
Niomi Farmer
Mary E. Johnson (Cookie)
Brad Harris
Kim Terrell
Lamont Fletcher

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
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HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown NJ 07962

MAILED
OCT 14 2011
OFFICE OF PETITIONS

In re Application of	:	
Ynjuin P. Wang, et al.	:	
Application No. 12/567,158	:	DECISION GRANTING PETITION
Filed: September 25, 2009	:	UNDER 37 CFR 1.313(c)(2)
Attorney Docket No. H0022017	:	

This is a decision on the petition under 37 CFR 1.313(c)(2), filed, October 13, 2011 to withdraw the above-identified application from issue after payment of the issue fee.

The petition is **GRANTED**.

The above-identified application is withdrawn from issue for consideration of a submission under 37 CFR 1.114 (request for continued examination). *See* 37 CFR 1.313(c)(2).

Petitioner is advised that the issue fee paid on September 8, 2011 cannot be refunded. If, however, this application is again allowed, petitioner may request that it be applied towards the issue fee required by the new Notice of Allowance.[1]

Telephone inquiries should be directed to Terri Johnson at (571) 272-2991.

This application is being referred to Technology Center AU 2887 for processing of the request for continued examination under 37 CFR 1.114 and for consideration of the concurrently filed information disclosure statement and amendment.

/Terri Johnson/
Terri Johnson
Petitions Examiner
Office of Petitions

[1] *The request to apply the issue fee to the new Notice may be satisfied by completing and returning the new Part B – Fee(s) Transmittal Form (along with any balance due at the time of submission). Petitioner is advised that the Issue Fee Transmittal Form must be completed and timely submitted to avoid abandonment of the application.*

PTO/SB/30 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	12/567,158 – Conf. # 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	3751
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
      ii. ☐ Other _____

   b. ☒ Enclosed
      i. ☒ Amendment/Reply
      ii. ☐ Affidavit(s)/Declaration(s)
      iii. ☒ Information Disclosure Statement (IDS)
      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☒ Other Petition to Withdraw Application from Issue

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☒ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any Overpayments, to Deposit Account No. 08-1935 .
      i. ☒ RCE fee required under 37 CFR 1.17(e)
      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)
      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/George S. Blasiak/	Date	October 13, 2011
Name (Print/Type)	George S. Blasiak	Registration No.	37,283

Request for Continued Examination Transmittal
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: October 13, 2011 Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

Amendment To Accompany Request for Continued Examination
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: October 13, 2011
Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: Karl D. Frech

AMENDMENT TO ACCOMPANY REQUEST FOR CONTINUED EXAMINATION

MS Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 9 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Original) An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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2. (Original) The EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

3. (Previously Presented) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

4. (Previously Presented) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

5. (Previously Presented) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

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Exhibit 1023 (Page 146)

6. (Previously Presented) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

7. (Previously Presented) The EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

8. (Previously Presented) The EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

9. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter

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(ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

10. (Original) The EIR terminal of claim 9, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

11. (Original) The EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

12. (Original) The EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

13. (Previously Presented) The EIR terminal of claim 9, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

14. (Previously Presented) The EIR terminal of claim 9, further configured to dynamically select at least one of a wireless communication network, a wireless

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communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

15. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

16. (Original) The EIR terminal of claim 15, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

17. (Original) The EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

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18. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

19. (Original) The EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

20. (Original) The EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets.

21. (Original) The EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

22. (Original) The EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

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23. (Original) The EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

24. (Canceled without prejudice or disclaimer)

25. (Canceled without prejudice or disclaimer)

26. (Canceled without prejudice or disclaimer)

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REMARKS

Applicant concurrently files a Request for Continued Examination (RCE) so that an additional Information Disclosure Statement (IDS) will be considered and further so that Applicant's cancellation of claims 24, 25 and 26 will be considered. The present amendment provides a submission to accompany the RCE.

No amendment presented herein contains new matter.

It is believed that all of the pending claims have been addressed. However, failure to address a specific rejection, issue or comment in the present file history does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made in the present file history are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in the present file history should be construed as an intent to concede any issue with regard to any claim, except as specifically stated, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Accordingly, in view of the above amendments and remarks, applicants believe all of the claims of the present application to be in condition for allowance and respectfully request reconsideration and passage to allowance of the application.

Dated: October 13, 2011

Respectfully submitted,
Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283

GB/nrp

HESLIN ROTHENBERG
FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
(518) 452-5600
Customer No.: 93689

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Exhibit 1023 (Page 152)

Petition to Withdraw Application From Issue (RCE)
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: October 13, 2011
Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 | Confirmation No.: 3751

Filed: September 25, 2009 | Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE | Examiner: Karl D. Frech

PETITION TO WITHDRAW APPLICATION FROM ISSUE PURSUANT TO 37 CFR §1.313(c)(2), 37 CFR §1.114, and 37 CFR §1.17(h)

MS Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The present petition is being filed to withdraw the above application from issue after payment of the issue fee to allow consideration of a Request for Continued Examination ("RCE") in compliance with *37 CFR §1.114*. An RCE is being filed concurrently herewith to allow consideration and entry of an Amendment and an Information Disclosure Statement ("IDS"), copies of which are enclosed.

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An issue fee in the present application was paid on September 8, 2011. When the present application is allowed again, the new Notice of Allowance will reflect an issue fee amount that is the difference between the current issue fee amount and the issue fee amount previously paid. *MPEP §706.07(h)(IX)*.

If the Patent Petition Office believes that contact with applicants' attorney would be advantageous toward the disposition of this case, the Office is herein requested to call applicants' representative at the phone number listed below.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 08-1935.

Dated: October 13, 2011

GSB/nrp

Respectfully submitted,
Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283
HESLIN ROTHENBERG
FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
(518) 452-5600
Customer No.: 93689

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Exhibit 1023 (Page 154)

Information Disclosure Statement
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: October 13, 2011
Electronic Signature for Nicole R. Pruett /Nicole R. Pruett/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: Karl D. Frech

INFORMATION DISCLOSURE STATEMENT (IDS)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The references cited on attached form PTO/SB08 are being called to the attention of the Examiner.

Pursuant to 37 CFR 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the “References Cited” on any patent to issue therefrom.

In accordance with 37 CFR 1.98(a)(2)(ii), Applicant has not submitted copies of U.S. patents and U.S. patent applications. Applicant submits herewith copies of foreign patents and non-patent literature in accordance with 37 CFR 1.98(a)(2).

In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. In accordance with 37 CFR 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that any patent, publication or other information referred to therein is “prior art” for this invention unless specifically designated as such.

It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

In column T^6 and T^2 of the attached PTO 1449 form, "EN" is entered where the cited reference is in the English language, "AO" is entered where the reference is not in English but a translation of the Abstract only is included, "FT" is entered where the reference is not in English but a full text English translation is included and “MT” is entered where the reference is not in English but a partial and/or full machine translation in English is included.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 08-1935.

Dated: October 13, 2011

Respectfully submitted,
Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283

GB/nrp

HESLIN ROTHENBERG
FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
(518) 452-5600
Customer No.: 93689

TransCore LP
Exhibit 1023 (Page 156)

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 9

Complete if Known	
Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-7,908,420	03-15-2011	Rofougaran et al.	
	AB*	US-7,903,724	03-08-2011	Rofougaran et al.	
	AC*	US-7,899,394	03-01-2011	Rofougaran et al.	
	AD*	US-7,893,790	02-22-2011	Van Delden	
	AE*	US-7,885,600	02-08-2011	Rofougaran et al.	
	AF*	US-7,874,483-A1	01-25-2011	Wang et al.	
	AG*	US-7,835,157	11-16-2010	Tilmans et al.	
	AH*	US-7,809,329	10-05-2010	Rofougaran et al.	
	AI*	US-7,795,700	09-14-2010	Rofougaran et al.	
	AJ*	US-7,750,435	07-06-2010	Rofougaran et al.	
	AK*	US-7,696,929	04-13-2010	Kaneda	
	AL*	US-7,617,342	11-10-2009	Rofougaran	
	AM*	US-7,586,387	09-08-2009	Van Delden	
	AN*	US-7,466,274	12-16-2008	Lin et al.	
	AO*	US-7,446,717	11-04-2008	Hung et al.	
	AP*	US-7,423,599	09-09-2008	Li et al.	
	AQ*	US-7,368,311	05-06-2008	Tilmans et al.	
	AR*	US-7,333,067	02-19-2008	Hung et al.	
	AS*	US-7,307,331	12-11-2007	Kipnis et al.	

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Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	BA	WO-9814023-A1	04-02-1998	Advanced Micro Devices Inc		EN
	BB	EP-2061285-A2	05-20-2009	Hand Held Prod Inc		EN

Examiner Signature		Date Considered	

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IDS (Citation) by Applicant (162 References)

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: October 13, 2011 Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

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	AT*	US-7,283,094	10-16-2007	Lee	
	AU*	US-7,265,731	09-04-2007	Vance et al.	
	AV*	US-7,251,499	07-31-2007	Ella et al.	
	AW*	US-7,218,678	05-15-2007	Katta et al.	
	AX*	US-7,202,819	04-10-2007	Hatch	
	AY*	US-7,190,728	03-13-2007	Kawada et al.	
	AZ*	US-7,072,690	07-04-2006	Shin et al.	
	AA1*	US-6,961,544	11-01-2005	Hagstrom	
	AB1*	US-6,937,196	08-30-2005	Korva	
	AC1*	US-6,911,945	06-28-2005	Korva	
	AD1*	US-6,751,470	06-15-2004	Ella et al.	
	AE1*	US-6,167,099	12-26-2000	Rader et al.	
	AF1*	US-5,903,825	05-11-1999	Goode et al.	
	AG1*	US-5,812,605	09-22-1998	Smith et al.	
	AH1*	US-5,579,341	11-26-1996	Smith et al.	
	AI1*	US-20110066774	03-17-2011	Rofougaran et al.	
	AJ1*	US-20100285634	11-11-2010	ROFOUGARAN et al.	
	AK1*	US-20100276498	11-04-2010	Rofougaran et al.	
	AL1*	US-20100238075	09-23-2010	Pourseyed	

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	AM1*	US-20100232474	09-16-2010	Rofougaran et al.	
	AN1*	US-20100079347	04-01-2010	Hayes et al.	
	AO1*	US-20100077115	03-25-2010	Rofougaran et al.	
	AP1*	US-20100022195	01-28-2010	ROFOUGARAN et al.	
	AQ1*	US-20090323783	12-31-2009	Buris et al.	
	AR1*	US-20090285135	11-19-2009	Rousu et al.	
	AS1*	US-20090227205	09-10-2009	Rofougaran et al.	
	AT1*	US-20090218657	09-03-2009	Rofougaran et al.	
	AU1*	US-20090180403	07-16-2009	Tudosoiu	
	AV1*	US-20090167457	07-02-2009	Melde et al.	
	AW1*	US-20090148074	06-11-2009	XU et al.	
	AX1*	US-20090121951	05-14-2009	Kaneda	
	AY1*	US-20090115549	05-07-2009	Lee	
	AZ1*	US-20090074106	03-19-2009	See et al.	
	AA2*	US-20090067388	03-12-2009	van Rooyen et al.	
	AB2*	US-20090058734	03-05-2009	ALI et al.	
	AC2*	US-20090037627	02-05-2009	Rofougaran et al.	
	AD2*	US-20090036067	02-05-2009	Rofougaran et al.	
	AE2*	US-20090033359	02-05-2009	Rofougaran et al.	

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	AF2*	US-20090028082	01-29-2009	Wynn et al.	
	AG2*	US-20090024550	01-22-2009	Wynn et al.	
	AH2*	US-20090006677	01-01-2009	Rofougaran et al.	
	AI2*	US-20080297404	12-04-2008	Lin et al.	
	AJ2*	US-20080278370	11-13-2008	Lachner et al.	
	AK2*	US-20080182613	07-31-2008	Rofougaran et al.	
	AL2*	US-20080181287	07-31-2008	Rofougaran et al.	
	AM2*	US-20080181186	07-31-2008	Rofougaran et al.	
	AN2*	US-20080157897	07-03-2008	Tilmans et al.	
	AO2*	US-20080150829	06-26-2008	Lin et al.	
	AP2*	US-20080150807	06-26-2008	Lin et al.	
	AQ2*	US-20080107213	05-08-2008	Gupta et al.	
	AR2*	US-20070257847	11-08-2007	Su et al.	
	AS2*	US-20060279446	12-14-2006	Wang et al.	
	AT2*	US-20060135084	06-22-2006	Lee	
	AU2*	US-20060128332	06-15-2006	van Rooyen et al.	
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	AY2*	US-20050128152	06-16-2005	Milosavljevic	
	AZ2*	US-20040249915	12-09-2004	Russell	
	AA3*	US-20020183013	12-05-2002	Auckland et al.	
	AB3*	US-20020055368	05-09-2002	Lee	
	AC3*	US-7,741,965	06-22-2010	Lai et al.	
	AD3*	US-7,202,776	04-10-2007	Breed	
	AE3*	US-7,161,357	01-09-2007	Lee et al.	
	AF3*	US-20110174877	07-21-2011	Fleck et al.	
	AG3*	US-20110153349	06-23-2011	Anderson et al.	
	AH3*	US-20110148586	06-23-2011	Anderson et al.	
	Ai3*	US-20110136457	06-09-2011	Yu	
	AJ3*	US-20110095950	04-28-2011	Yu	
	AK3*	US-20100127085	05-27-2010	Yamagajo et al.	
	AL3*	US-20090322490	12-31-2009	Kung et al.	
	AM3*	US-20090073065	03-19-2009	Jordan	
	AN3*	US-20090032592	02-05-2009	Christensen	
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	AR3*	US-20070060089	03-15-2007	Owen et al.	
	AS3*	US-20060261938	11-23-2006	Lai et al.	
	AT3*	US-20060261821	11-23-2006	Lee et al.	
	AU3*	US-20060070089	03-30-2006	Shoaib et al.	

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	AV3*	US-7,592,957	09-22-2009	Achour et al.	
	AW3*	US-7,764,232	07-27-2010	Achour et al.	
	AX3*	US-7,839,216	11-23-2010	Alidio et al.	
	AY3*	US-7,839,236	11-23-2010	Dupuy et al.	
	AZ3*	US-7,847,739	12-07-2010	Achour et al.	
	AA4*	US-7,855,696	12-21-2010	Gummalla et al.	
	AB4*	US-20080048917	02-28-2008	Maha et al.	
	AC4*	US-20080258981	10-23-2008	Maha et al.	
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	AE4*	US-20090128446	05-21-2009	Gummalla et al.	
	AF4*	US-20090135087	05-28-2009	Gummalla et al.	
	AG4*	US-20090160575	06-25-2009	Dupuy et al.	
	AH4*	US-20090160578	06-25-2009	Maha Achour	
	AI4*	US-20090219213	09-03-2009	Lee et al.	
	AJ4*	US-20090245146	10-01-2009	Gummalla et al.	
	AK4*	US-20090251385	10-08-2009	Xu et al.	
	AL4*	US-20090289737	11-26-2009	Itoh et al.	
	AM4*	US-20090295473	12-03-2009	Dupuy et al.	
	AN4*	US-20090295483	12-03-2009	Alidio et al.	
	AO4*	US-20090295660	12-03-2009	Xu et al.	
	AP4*	US-20090316612	12-24-2009	Poilasne et al.	
	AQ4*	US-20100045554	02-25-2010	Xu et al.	
	AR4*	US-20100060544	03-11-2010	Penev et al.	
	AS4*	US-20100073254	03-25-2010	Lee et al.	

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Application Number	12/567,158 – Conf. #. 3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	Karl D. Frech
Attorney Docket Number	H0022017

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Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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	AU4*	US-20100109971	05-06-2010	Gummalla et al.	
	AV4*	US-20100109972	05-06-2010	Xu et al.	
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(71) **Applicant:** ADVANCED MICRO DEVICES, INC. [US/US]; 5204 East Ben White Boulevard, Mail Stop 562, Austin, TX 78741 (US).

(72) **Inventors:** ASGHAR, Saf, M.; 7010 Quill Leaf Cove, Austin, TX 78750 (US). SPAK, Michael, E.; Box 170, Route 1, Kyle, TX 78640 (US).

(74) **Agent:** RILEY, Louis, A.; Advanced Micro Devices, Inc., 5204 East Ben White Boulevard, M/S 562, Austin, TX 78741 (US).

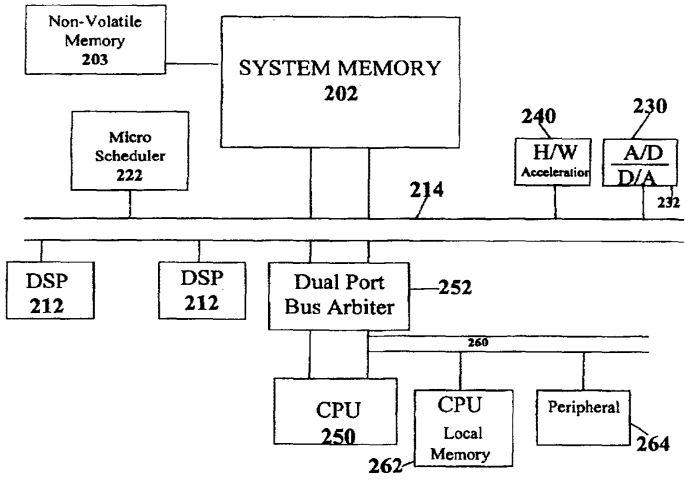
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(54) **Title:** CONFIGURABLE DIGITAL WIRELESS AND WIRED COMMUNICATIONS SYSTEM ARCHITECTURE

(57) **Abstract**

A configurable multiprocessor communications architecture which performs digital communications functions and which is configurable for different digital communications standards, such as various digital cellular standards. In the preferred embodiment, the multiprocessor architecture includes two or more digital signal processing cores (212), a microcontroller or microscheduler (222), a voice coder/decoder (codec), and a relatively low performance central processing unit (CPU) (250). Each of the above devices are coupled to a system memory (202). The general purpose CPU preferably performs user interface functions and overall communications management functions. A CPU local memory (262) and various peripheral devices (264) are coupled through a CPU local bus (260) to the CPU, and these devices are accessible to the CPU without the CPU having to access the main system bus. A dual port bus arbiter (252) is preferably coupled between the CPU and the system bus (214) and controls access to the system bus and the CPU local bus. The microscheduler operates to schedule operations and/or functions, as well as dynamically control the clock rates, of each of the DSPs and the hardware acceleration logic (240) to achieve the desired throughput while minimizing power consumption. The present invention thus provides a single architecture which has simplified configurability for different digital standards. The configurable digital communications architecture simplifies design and manufacturing costs and provides improved performance over prior designs.



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Title: Configurable Digital Wireless and Wired Communications System Architecture

Field of the Invention

The present invention relates to communications systems for wired and wireless environments, and more particularly to a communications architecture for wired and wireless communication environments which is configurable according to a plurality of possible different digital transmission standards.

Description of the Related Art

Wireless information networks are currently experiencing enormous growth throughout the world. Examples of wireless information networks include cordless telephones, personal communications services (PCS), cellular telephones, paging systems, mobile data networks, and mobile satellite systems. In conjunction with the growth in wireless information networks, communications networks are currently undergoing a transition from analog-based technology to digital technology. Wireless information networks will benefit greatly from digital implementations, including better performance, increased capacity, and a wider offering of services.

Various types of wireless information networks exist, including networks designed for voice and data. In general, different networks exist for voice and data because of the different and often contradictory requirements of voice service and data service. Thus, although digitized voice, video and data are all "binary digits" (bits), each service has different requirements in a digital network. For example, wireless voice data services are required to be comparable to a user's expectation of telephone voice quality in the public switched telephone network (PSTN). Thus, packetized voice service in a wireless network must minimize time delays in transmission. In general, in a voice transmission, inter-packet delays in excess of 100 msec are noticeable and annoying to the listener. In contrast, in a data services network, time delays are generally irrelevant to the user. Also, packetized voice service can tolerate packet loss rates on the order of 10^{-2},

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or bit error rates of the same order, without a noticeable degradation of service quality. In contrast, data services require a much lower error rate, and loss of data packets is generally unacceptable. Voice conversations also typically generate Megabytes of digitized information and last at least several minutes, whereas data transfers typically involve less data and are shorter in length.

Thus, wireless information networks typically involve either voice-driven applications such as digital cellular, PCS, cordless telephones, and wireless PBX, or data-driven networks such as wireless LANs and mobile data networks. For voice applications, digital cellular systems are designed to support mobile users roaming over wide geographic areas, whereas PCS, cordless telephones and wireless PBX systems are designed for relatively smaller geographic areas. For data applications, mobile data networks operate a relatively low data rates over urban radio channels, whereas wireless LANs are typically designed to support a limited number of users in a well-defined local area.

Cellular mobile telephone service is one of the most rapidly growing segments of the wireless communications industry. As mentioned above, digital cellular system is designed to support mobile users roaming over wide geographic areas, and thus coverage is provided by an arrangement of cells with a cell size typically 0.5 to 5 miles in diameter. There are currently several digital cellular standards initiatives in the United States, Europe, and Japan, including GSM (Groupe Special Mobile), IS-54, Japanese Digital Cellular (JDC), and Code Division Multiple Access (CDMA). Thus, current digital cellular telephone architectures are required to accommodate a plurality of different digital communication standards.

Current digital cellular telephone architectures generally include a different integrated circuit chip set, particularly in the baseband section, for accommodating each of these digital standards. Each of these different IC chipsets for performing different digital standards is generally only available from a few select companies, thus limiting the amount of product differentiation between manufacturers.

The use of different integrated circuits for each of the digital standards also adversely effects the telephone manufacturing process. As noted above, different market

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segments generally utilize different digital standards. For example, Europe is primarily based on the GSM standard, whereas the U.S. is primarily based on the IS54 standard. Therefore, for a company to participate in each of these various market segments for cellular telephones, the company is required to maintain multiple production flows, resources, reliability testing, packaging, port assembly and testing requirements for each of the digital standards that are supported. This necessarily leads to high manufacturing costs, which increases the cost of the overall system.

Therefore, an improved configurable architecture for digital communications applications is desired. More particularly, a new baseband architecture for digital communications is desired which provides reduced power consumption and more efficiency in executing the baseband operations of various digital communication standards. A new baseband architecture for digital communications is further desired which is easily configurable between different digital communications standards, thus simplifying the manufacturing process.

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Summary of the Invention

The present invention comprises a configurable multiprocessor communications architecture which performs various digital communications functions and which is configurable for different digital communications standards, such as various digital cellular standards. In the preferred embodiment, the multiprocessor architecture includes, preferably on a single integrated circuit, two or more digital signal processing cores, a microcontroller, a voice coder/decoder (codec), and a relatively low performance central processing unit. Each of the above devices are coupled to a system memory. The configurable digital communications architecture simplifies design and manufacturing costs and provides improved performance over prior designs.

In the preferred embodiment, the digital communications architecture includes one or more processor cores, preferably digital signal processors (DSPs), coupled through a system bus to a common DSP memory or system memory. The common DSP memory stores code and data used by the one or more DSPs. In one embodiment, two or more DSPs are connected to the system bus, and the two or more DSPs are also coupled through dedicated address and data buses. In this embodiment, the two or more DSPs communicate through the dedicated address and data buses without requiring system bus access. In another embodiment, two or more DSPs are daisy chained to the system bus, and one DSP performs system bus accesses for all of the daisy chained DSPs.

A micro-scheduler is coupled to the system bus and operates to schedule operations and/or functions of the one or more DSPs and the hardware acceleration logic. A general purpose CPU is also coupled to the system bus. The general purpose CPU preferably performs user interface functions and overall communications management functions, among others. A CPU local memory and various peripheral devices are coupled through a CPU local bus to the CPU. Specialized hardware acceleration logic, such as for encryption, may also be coupled to the system bus.

A dual port bus arbiter is preferably coupled between the CPU and the system bus and controls CPU access to the system bus and hence to the DSP memory or system memory. Thus the CPU gains access to the system bus and hence to the DSP memory through the dual port bus arbiter. The CPU local bus is preferably coupled between the

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CPU and the dual port bus arbiter to allow the CPU to access the CPU local memory and the various peripheral devices without having to access the main system bus. In this embodiment, other devices gain access to the CPU local memory through the dual port bus arbiter.

The CPU accesses the DSP memory to store code and data for use by other devices or to pass messages to the micro-scheduler through a semaphore in the memory. The CPU can also access the DSP memory to store code and data to set up operations which are to be performed by the DSPs under control of the micro-scheduler.

Once the micro-scheduler has received a task from the CPU, the micro-scheduler operates to assign different functions or tasks to the one or more DSPs and the hardware acceleration logic to perform the desired communication operation. During this time, the CPU generally does not have access to the system bus, but rather performs operations using its local CPU memory. The micro-scheduler preferably partitions tasks among each of the DSPs and the hardware acceleration logic to achieve the desired throughput while minimizing power consumption. The micro-scheduler also preferably dynamically controls the clock rates of each of the DSPs to achieve a desired computational throughput while minimizing power consumption.

The digital communications architecture of the present invention is configurable between different communications standards and also different communications applications. Thus, for a manufacturer of digital cellular devices, the digital communications architecture of the present invention can be easily programmed to operate according to the GSM standard, the IS54 standard, a CDMA standard, or a TDMA standard, among others. In addition, the digital communications architecture of the present invention can be easily programmed to operate as a digital cellular device, a cordless phone, or a personal communicator in a PCS system.

The configurable communications architecture of the present invention takes advantage of the synergy or commonality in algorithmic performance in the various digital cellular and digital communications standards. The present invention thus essentially provides a modular building block structure for constructing solutions for various digital cellular standards. According to the present invention, the hardware

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function units comprised in the architecture utilize a common interconnect, i.e. hardware platform, which remains constant. This hardware architecture is sufficiently flexible to be programmable to perform different functions and/or to operate according to different cellular standards. This removes the problems of the telephone manufacturer having to deal with multiple production and sourcing related issues.

The present invention thus provides a single architecture which has simplified configurability for different digital standards. This enables a reduction in telephone manufacturing costs and processes, in addition to simplified silicon design. In other words, the configurable architecture of the present invention utilizes a single hardware architecture for operating according to multiple different cellular standards, thus easing production and sourcing problems. In the preferred embodiment, the telephone manufacturer simply programs code for the appropriate wireless or wired digital cellular standard prior to shipping the final product.

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Brief Description of the Drawings

A better understanding of the present invention can be obtained when the following detailed description of the preferred embodiment is considered in conjunction with the following drawings, in which:

Figure 1 illustrates a digital communications device which includes a configurable digital cellular architecture according to the present invention;

Figure 2 is a block diagram of the configurable digital cellular architecture of the present invention;

Figure 3 is a more detailed block diagram of the configurable digital cellular architecture of the preferred embodiment;

Figure 4 is a flowchart diagram illustrating operation of the present invention; and

Figure 5 illustrates an alternate embodiment where the micro-scheduler is coupled to the CPU local bus;

Figure 6 illustrates an alternate embodiment where two sets of two DSPs are coupled to the system bus in a daisy chain fashion;

Figure 7 illustrates an alternate embodiment where two DSPs are coupled to the system bus and are also coupled through dedicated address and data lines; and

Figure 8 illustrates an alternate embodiment where two DSPs and the CPU are coupled to the system bus and are also coupled through dedicated address and data lines.

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Detailed Description of the Preferred Embodiment

Digital Communications Device

Referring now to Figure 1, a digital communications device 100 which includes the configurable digital architecture of the present invention is shown. In the preferred embodiment, the digital communications device 100 is a digital cellular device for wireless communications. However, the digital communications device may comprise other devices, as desired. As discussed below, the digital cellular device 100 is programmable to operate according to a variety of digital cellular standards, including the GSM standard, the IS54 standard, a CDMA standard, or a TDMA standard, among others. In addition, the digital communications architecture of the present invention can be easily programmed to operate as various digital communications devices, including a digital cellular device, a cordless phone, or a personal communicator in a PCS system, among others.

Configurable Architecture Block Diagram

Referring now to Figure 2, a block diagram illustrating a configurable multiprocessor architecture for digital communication applications is shown. The configurable multiprocessor architecture of the present invention is preferably configurable to operate according to various different digital standards, such as different digital cellular standards. It is noted that Figure 2 illustrates a portion of the hardware components comprised in the digital communications device 100, such as a digital cellular telephone. Also, the logic components shown in Figure 2 are preferably comprised on a single monolithic substrate and/or are preferably comprised as a single integrated circuit.

As shown, the communications device 100 includes a memory 202. The memory 202 stores program code and data which enables the communications device 100 to be configurable according to one or more of a plurality of different communication standards. For example, in the preferred embodiment, the memory 202 stores program

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code and data which enables the communications device 100 to operate according one or more of various digital cellular standards, such as GSM (group special mobile), IS54, and code division multiple access (CDMA), among others.

In one embodiment, the memory 202 is a multiport memory which includes a plurality of read/write ports. This allows multiple devices to simultaneously access the memory 202. In another embodiment, the memory 202 is a single port memory, and the system includes a dual port bus arbiter (Figure 3) which controls arbitration for the memory 202, as described further below.

As shown, the digital communications device 100 includes one or more digital signal processors 212 coupled to the memory 202 for performing communications functions. In the preferred embodiment of the invention, the architecture includes one or more first digital signal processors 212a which are configured or designated to perform transmit functions, and one or more digital signal processors 212b which are configured to perform receive functions. The embodiment of Figure 2 includes two first digital signal processors 212a and two second digital signal processors 212b. In the preferred embodiment, the digital communications device architecture includes only one first digital signal processor 212a which performs transmit functions and only one second digital signal processor 212b which performs receive functions.

Each of the DSPs 212 preferably comprises the ADSP 2171 core available from Analog Devices. In the preferred embodiment, the DSP core is preferably comprised of the ADSP 2171 core and includes certain architecture enhancements which provide improvements in the execution of algorithms or functions required for various digital communication standards. These architectural enhancements are discussed further below.

As shown, the system includes a microcontroller or micro-scheduler 222 which operates to control the operation of each of the transmit DSPs 212a and receive DSPs 212b. The micro-scheduler 222 performs scheduling operations to schedule operation of each of the DSPs 212. Micro-scheduler 222 also places the system in one or more desired modes, such as a parallel processing mode where each of the DSPs 212 are operating in parallel, or a master/slave mode where a first DSP 212 is designated as the master and the

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remaining DSPs 212 are designated as slave DSPs which receive tasks assigned by the master DSP.

Microcontroller 222 preferably is an efficient low power controller which operates as the central sequence or a task scheduler for the entire digital communications architecture. The sequencer or microcontroller 222 is preferably configured in a manner which allows the addition of computational units or DSPs without requiring a redesign of the sequencer or of memory hardware. According to the present disclosure, the term "computational units" is intended to include elements such as digital signal processing cores, custom logic, serial ports, and hardware acceleration logic, among others.

The microcontroller or sequencer 222 preferably controls each of the DSPs 212 and/or computational units in a manner which balances the computational throughput and power consumption based on the application being performed. Thus the microcontroller 222 preferably balances the tasks or functions assigned to each DSP 212 depending on the amount of computational throughput required. The microcontroller 222 also preferably controls the clock rate of each of the DSPs depending on the computational throughput and power consumption. Thus, for a computational intensive task which requires immediate response, the micro-scheduler 222 partitions the task among two or more DSPs or computational units, and operates the two or more DSPs or computational units at a full clock rate. For tasks which are not computationally intensive, the micro-scheduler 222 partitions the task among one or more of the DSPs or computational units, and operates the one or more DSPs or computational units at a slower clock rate to reduce power consumption.

In one embodiment, the microcontroller or sequencer 222 is an ARM-like processor, which acts as the central sequencer/controller. In this embodiment, software used to program the microcontroller 222 is preferably written in C or in similar higher level language using currently available development tools, i.e. C compilers, simulators, and debuggers. This provides a high level development platform for performing the design of the digital communications device, and also provides flexibility for changes or new features.

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The system preferably includes a general purpose CPU 250 which acts as the overall controller of the system. The CPU 250 comprised in the system of the present invention communicates with the micro-scheduler 222 and provides communications tasks to the micro-scheduler 222. The CPU 250 also preferably performs user interface functions, receiving and processing user commands. In one embodiment, the CPU 250 performs an intelligent multimode configurable communicator application. In other words, in one embodiment the CPU 250 executes an application which enables the digital communications device to operate according to different desired modes or digital standards. The CPU 250 also preferably implements various protocol stacks as appropriate due to the variability and the various standard specifications.

As shown, the digital communications system includes analog to digital conversion logic 230 and digital to analog conversion logic 232. The analog to digital (A/D) conversion logic 230 receives analog signals and provides corresponding digital signals to either one or more of the digital signal processors 212, 214, the CPU 250 or to the memory 202. The digital to analog (D/A) conversion logic 232 receives digital signals from the DSPs 212 or 214 or from the memory 202 and provides corresponding analog signals output from the communication device.

The digital communications device also preferably includes hardware acceleration logic for performing certain tasks and hardware. The hardware accelerator logic 240 preferably performs functions such as data coding or encryption, or other functions which require specialized or dedicated hardware.

Common Hardware for Different Digital Cellular Standards

As mentioned above, the configurable digital communications architecture shown in Figure 2 is configurable according to various communications standards. The present invention takes advantage of the commonality of functional requirements between each of the digital cellular standards.

In general, each digital cellular standard includes a baseband section comprising baseband logic for performing operations on the voice or data signals at the baseband frequency level. A typical baseband transmission block includes voice coding, channel

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coding, protocol handling, and modulation functions. Voice coding algorithms are generally based on code excited linear prediction methods. The voice coding algorithms used for each of the different cellular standards typically differ in bit rates, code books and error control used in the linear prediction voice coding algorithm. However, each of these voice coding algorithms are similar in execution and complexity from a computational standpoint. Channel coding and protocol stack functions are also similar in concept for each of the different digital cellular standards. However, differences exist in the length of the convolutional coding elements, trellis coding and viterbi decoding. The modulation used by the baseband sections of each of the digital cellular standards typically use well-known quaternary phase shift keying (QPSK) or GMSK modulation schemes.

Once voice signals have been digitized in a digital cellular voice call, the transmission flow resembles operation of a high speed modem. In a wired medium, the propagation channel is generally time invariant, whereas in the wired medium the propagation channel is time varying.

The design of the receiver station of both wired and wireless media generally has similar architecture features. However, the wireless receiver is generally far more complex in order to handle multipath fading characteristics of the channel. In analyzing the transmit and receive sections of a digital cellular architecture, it is apparent that the speech encoding algorithm in the transmit section requires the most computations and complexity. The receive section is dominated by channel equalization and viterbi estimation.

According to the configurable digital communication architecture of the present invention. the wireless and wired modem architectures are treated in a similar manner, thus producing a number of significant advantages. One advantage is that the transmission path can now be broken into two distinct sections, i.e., the transmit block can be treated as an independent block from the receive section.

As discussed above, prior art systems employ a single digital signal processor to execute the complete baseband functionality of a digital communications device. This inherently leads to high power consumption, high clock rates and excessive overhead in

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maintaining program flow and interrupts. Memory design also becomes an issue at higher clock rates.

The present invention provides a new communication architecture for digital communications which provides reduced power consumption and more efficiency in executing the baseband operations of various digital communication standards. As mentioned above, the system of the present invention includes two or more DSPs or computational units 212 and also includes a micro-scheduler 222 which dynamically assigns tasks and clock rates to achieve a desired computational throughput with reduced power consumption. This enables the use of lower clock rates in the system, thus reducing power requirements.

Also, by partitioning the communication functions, such as transmit and receive functions, between multiple processors, under the command of a controller, functional units in the digital communication system can operate in various modes, such as in a parallel processor mode or in a master/slave mode. Further, due to the use of multiple processors performing separate functions, the system can operate at lower clock rates which are sufficient to implement the required functionality. This enables power consumption to be controlled more easily. The present invention further includes circuit design techniques which further reduce power dissipation.

The multiprocessor architecture of the present invention also preferably utilizes one or more transmit digital signal processors 212a and one or more receive digital signal processors 212b. The transmit DSPs 212a perform the transmit function, whereas the receive DSPs 212b perform the receive function. Implementation of the transmit and the receive functions in different digital signal processors provides flexibility and scalability,

The overall architecture is also programmable or configurable according to various different digital communication standards and voice coding algorithms. This configurability allows the manufacturer to produce one hardware architecture which can then be configured according to various desired standards. This obviates the necessity of the telephone manufacturer having to deal with multiple production and sourcing related issues.

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Figure 3 - Block Diagram

Referring now to Figure 3, a more detailed block diagram illustrating the preferred embodiment of the invention is shown. Elements in Figure 3 which are similar or identical to elements in Figure 2 have the same reference numerals for convenience. The elements or components shown in Figure 3 are preferably all comprised on a single monolithic silicon substrate and/or are preferably comprised as a single integrated circuit.

As shown, the digital communications system includes one or more processor cores 212 coupled through a bus 214 to a common DSP memory or system memory 202. The processor cores 212 are preferably digital signal processors, although other types of processor units may be used. In the preferred embodiment, the system includes two DSPs 212, although a greater or lesser number of DSPs may be used.

Specialized hardware acceleration logic 240 may also be coupled to the bus 214. The hardware acceleration logic 240 is included to perform certain functions in dedicated hardware due to computational requirements. In the preferred embodiment, the hardware acceleration logic 240 performs data encryption operations.

Microcontroller or micro-scheduler 222 is coupled to the bus 214 and operates to schedule operations and/or functions of the one or more DSPs 212 and the hardware acceleration logic 240. A general purpose CPU 250 is also coupled to the bus 214. The general purpose CPU 250 preferably performs user interface functions and overall communications management functions, among others.

The digital communications system includes analog to digital conversion logic 230 and digital to analog conversion logic 232. The analog to digital (A/D) conversion logic 230 receives analog signals and provides corresponding digital signals to either one or more of the digital signal processors 212, 214, the CPU 250 or to the memory 202. The digital to analog (D/A) conversion logic 232 receives digital signals from the DSPs 212 or 214 or from the memory 202 and provides corresponding analog signals output from the communication device. The A/D logic 230 and the D/A logic 232 are primarily used for converting analog speech signals to digital signals, and for converting digital

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speech signals to analog speech signals. In one embodiment, the A/D logic 230 and the D/A logic 232 are comprised in a voice coder / decoder (codec).

The common DSP memory or system memory 202 stores code and data used by the one or more DSPs 212, as well as for the hardware acceleration logic 240, the micro-scheduler 222, and the CPU 250.

A non-volatile memory 203 is coupled to the system memory 202 and stores code and data necessary to implement one or more digital cellular standards. Code and data is programmed into the non-volatile memory 203 by the manufacturer to program or configure the system according to a desired digital standard, such as a digital cellular standard. At power-up, the code and data from the non-volatile memory 203 is preferably transferred to the system memory 202 for use within the system. In one embodiment, code and data for two or more digital cellular standards are programmed into the non-volatile memory 203, and the user can selectively configure the digital communications device according to one of these desired digital cellular standards, depending on the location where the device is used.

A bus arbiter 252, referred to as a dual port bus arbiter 252, is preferably coupled between the CPU 250 and the bus 214 and controls access to the bus 214 and hence to the system memory 202. A CPU local memory 262 and various peripheral devices 264 are coupled through a CPU local bus 260 to the CPU 250. The CPU local bus 260 is coupled between the CPU 250 and the dual port bus arbiter 252 to allow the CPU 250 to access the CPU local memory 262 and the various peripheral devices 264 without having to access the main system bus 214. The non-volatile memory 203 may be coupled to the CPU local memory 262 for providing code and data to the CPU local memory 262 during power-on. As mentioned above, the non-volatile memory 203 stores code and data which allows the digital communications device to operate according to a desired digital cellular standard.

As mentioned above, the dual port bus arbiter 252 controls access to the system bus 214 and hence to the system memory or DSP memory 202. The CPU 250 accesses the system memory 202 to store code and data for use by other devices or to pass messages to the micro-scheduler 222 through a semaphore in the system memory 202.

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The CPU 250 also accesses the DSP memory 202 to store code and data to set up operations which are to be performed by the DSPs 212 under control of the micro-scheduler 222.

Once the micro-scheduler 222 has received a task from the CPU 250, the micro-scheduler operates to assign different functions or tasks to the one or more DSPs 212 and the hardware acceleration logic 240 to perform the desired communication operation. During this time, the CPU 250 generally does not have access to the system bus 214, but rather performs operations using its local CPU memory 262. Thus, after the CPU 250 accesses the memory 202 to set up a transmit or receive operation, the micro-scheduler 222 gains access to the bus 214 to access the memory 202 and assign tasks to different DSPs 212. The CPU 250 operates out of its CPU local memory 262 during this time that it is "locked out" of the memory 202.

Thus the dual port bus arbiter 252 controls access to the system bus 214 and hence to the DSP memory 202. Once the CPU 250 has set up an operation and relinquished control to the micro-scheduler 222, the dual port bus arbiter 252 controls access to the system bus 214 between the micro-scheduler 222, the DSPs 212, and the hardware acceleration logic 240.

In one embodiment, the dual port bus arbiter 252 also controls access to the CPU local memory 262 from other devices, such as the micro-scheduler 222. Thus when the micro-scheduler 222 desires to read or write a location in the CPU local memory 262, the micro-scheduler 222 requests access to the CPU local bus 260 through the dual port bus arbiter 252. The CPU 250 has priority access to the CPU local bus 260.

The digital communications architecture of the present invention is configurable between different communications standards and also different communications applications. Thus, for a manufacturer of digital cellular devices, the digital communications architecture of the present invention can be easily programmed to operate according to the GSM standard, the IS54 standard, a CDMA standard, or a TDMA standard, among others. In addition, the digital communications architecture of the present invention can be easily programmed to operate as a digital cellular device, a cordless phone, or a personal communicator in a PCS system.

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The configurable multiprocesser architecture of the present invention takes advantage of the synergy or commonality in algorithmic performance in the various digital cellular and digital communications standards. The present invention thus essentially provides a modular building block structure for constructing solutions for various digital cellular standards. According to the present invention, the hardware function units comprised in the architecture utilize a common interconnect, i.e. hardware platform, which remains constant. This hardware architecture is sufficiently flexible to be programmable to perform different functions and/or to operate according to different cellular standards. This removes the problems of the telephone manufacturer having to deal with multiple production and sourcing related issues.

Flowchart Diagram

Referring now to Figure 4, a flowchart diagram illustrating operation of the preferred embodiment of the present invention is shown.

As shown, in step 402 the CPU writes code and data to the system memory 202 to configure the microcontroller 222 to perform desired functions. Thus in step 402 the CPU 250 sets up a communications function, such as a transmit or receive function, by writing the appropriate code and data to the system memory 202. This code and data provides the necessary information which enables the microcontroller 222 to begin a communications function.

In step 404 the microcontroller 222 accesses the code and data written by the CPU 250 from the system memory 202. In step 406 the microcontroller selectively assigns functions to the one or more digital signal processors 212 based on the code and data written by the CPU 250. Thus the microcontroller or micro-scheduler 222 acts to assign functions or tasks to one or more of the DSPs based on the function being performed. In step 408 the one or more digital signal processors 212 perform digital communications functions in response to the microcontroller 222 selectively assigning functions to the one or more digital signal processors 212. It is noted that, during this time, the CPU 250 accesses code and data from the CPU local memory 262 in step 410. Thus the micro-scheduler 222 acts to assign functions or tasks to the one or more of the DSPs in step 408

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substantially contemporaneously with the CPU 250 accessing code and data from the CPU local memory 262 in step 410.

The microcontroller 222 preferably selectively assigns tasks to each of the one or more digital signal processors 212 to attain a desired computational throughput while also minimizing power consumption. Each of the one or more digital signal processors is configurable to operate at one of a plurality of different clock rates. In the preferred embodiment, the microcontroller 222 selectively controls the clock rates of each of the one or more digital signal processors 212 to reduce or minimize power consumption. Thus, the microcontroller 222 may assign a task to only one DSP 212 and operate the DSP 212 at its full clock rate to perform the task. The microcontroller 222 may also partition the task between two or more of the DSPs 212 and operate each of the DSPs 212 at half their full clock rate to perform the task in order to reduce power consumption.

Programming the System according to a Desired Digital Standard

In order to program the hardware system of Figure 3 according to a desired digital communications standard, such as a digital cellular standard, code and data is stored or written into non-volatile memory 203 which is coupled to the system memory 202. The code and data stored in the non-volatile memory 203 is in accordance with the digital standard. Thus, if it is desired to program the system for the GSM digital cellular standard, code and data is programmed into the non-volatile memory 203 which performs operations according to this digital standard. Upon power-up, the code and data stored in the non-volatile memory 203 is transferred to the system memory 202 for use in the system. Code and data stored in the non-volatile memory 203 may also be transferred to the CPU local memory 262 for execution by the CPU. Alternatively, a separate non-volatile storage memory (not shown) is coupled to the CPU local memory 262 for providing code and data to the CPU local memory 262 during power-up.

Figure 5 - Micro-scheduler coupled to CPU Local Bus (Alternate Embodiment)

Referring now to Figure 5, an alternate embodiment of the invention is shown. In the embodiment of Figure 5, the micro-scheduler or microcontroller 222 is coupled to the

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CPU local bus 260. This enables the CPU 250 and the microcontroller 222 to communicate on the CPU local bus 260, thus freeing up the system bus 214 for use by the DSPs 212. The microcontroller 222 accesses the system bus 214 and hence the system memory 202 through the dual port bus arbiter 252. The microcontroller 222 preferably uses the CPU local memory 262 for operations and writes code and data to the system memory 202 to assign functions or tasks to the DSPs 212.

Figure 6 - DSP Daisy Chain Embodiment

Referring now to Figure 6, an alternate embodiment of the invention is shown. In the embodiment of Figure 6, two or more DSPs 212 are coupled to the system bus 214 in a daisy chain format. In other words, a first DSP 212 is coupled to the system bus 214, and a second DSP 212 is coupled to the first DSP 212. In the embodiment of Figure 6, two sets or groups of first and second DSPs are shown coupled to the system bus 214. For each group of first and second DSPs, the first DSP 212 accesses code and data from the system memory 202 that is required for both of the first and second DSPs 212. This limits the required accesses to the system bus 214 and hence to the system memory 202.

Thus, in this embodiment, only the first DSP 212 in a group of two or more DSPs is assigned a task by the microcontroller 222. In response, the first DSP 212 reads code and data from the system memory 202 that is required for both of the first and second DSPs 212 in the group. The first DSP 212 then partitions tasks between the first and second DSPs 212. The first and second DSPs 212 operate in either a parallel processing mode or a master/slave mode to accomplish the assigned task, using the code and data retrieved by the first DSP 212.

Figure 7 - Dedicated DSP Buses (Alternate Embodiment)

Referring now to Figure 7, an alternate embodiment of the invention is shown. In the embodiment of Figure 7, two or more DSPs 212 are coupled to the system bus 214, and the system includes dedicated address and data buses coupled between the two or more DSPs 212. This enables the two or more DSPs 212 to communicate via the dedicated address and data buses without having to access the system bus. For example,

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this facilitates the operation of the two or more DSPs 212 in a master/slave mode or a parallel processing mode. For more information on this embodiment, please see EPO patent number 0465054, and U.S. Patent application Serial No. 07/548,709, which are both hereby incorporated by reference as though fully set forth herein.

In one embodiment of the invention, each of the DSPs 212 include a separate local memory (not shown), and each of the DSPs 212 execute code and data out of their respective local memories. This reduces the arbitration and contention for the system memory 202. The DSP local memories in this embodiment are also used for communication between each of the DSPs, using the dedicated address and data buses.

Figure 8 - Dedicated Buses Between DSPs and CPUs (Alternate Embodiment)

Referring now to Figure 8, an alternate embodiment of the invention is shown. In the embodiment of Figure 7, two or more DSPs 212 are coupled to the system bus 214, and the system includes dedicated address and data buses coupled between the two or more DSPs 212 and the CPU 250. This enables the two or more DSPs 212 and the CPU 250to communicate via the dedicated address and data buses without having to access the system bus.

In another embodiment (not shown), the system includes dedicated address and data buses coupled between the two or more DSPs 212 and the micro-scheduler 222. This enables the micro-scheduler 222 to more easily assign tasks, such as passing commands and data, to the two or more DSPs 212.

DSP Functional Enhancements to the ADSP Architecture

In the preferred embodiment, each of the DSPs 212 comprises the ADSP 2171 core available from Analog Devices. As noted above, in the preferred embodiment the DSP core is preferably comprised of the ADSP 2171 core and includes certain architecture enhancements which provide improvements in the execution of algorithms or functions required for various digital communication standards. These architectural enhancements are listed below.

1. Shadowing of Address Generation Registers.

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2. Shadowing of all Registers to 2 levels.
3. Register File to separate Dual Memories from Functional Units.
4. Using a register file to separate dual memories from functional units allows Parallel Operation of Functional Units, including pipelining the ALU with the MAC and pipelining the ALU with the Shifter. This also supports Table Search Algorithms.
5. Exploit Internal DRAM spare cycles for Data I/O.
6. Enhanced Instructions to Support Channel Coding/Decoding: Data Compare and Pointer Save.
7. Post and Pre scaling for MAC operations to allow easier Data Normalisation.

These features are added to the ADI Architecture at a cost of increasing Instruction word length and memory architecture. Also, the ability to add/subtract functional units tailored to particular applications and modifying the instruction set accordingly provides a more modular approach to the DSP Architecture and allows cost-effective solutions in price-sensitive markets. Support tools may also be provided to cover these enhancements to allow ease of programmability for embedded applications.

Conclusion

The present invention thus provides a single architecture which has simplified configurability for different digital standards. This enables a reduction in telephone manufacturing costs and processes, in addition to simplified silicon design. In other words, the configurable architecture of the present invention utilizes a single hardware architecture for operating according to multiple different cellular standards, thus easing production and sourcing problems. In the preferred embodiment, the telephone manufacturer simply programs code for the appropriate wireless or wired digital cellular standard prior to shipping the final product.

Although the system and method of the present invention has been described in connection with the preferred embodiment, it is not intended to be limited to the specific form set forth herein, but on the contrary, it is intended to cover such alternatives,

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modifications, and equivalents, as can be reasonably included within the spirit and scope of the invention as defined by the appended claims.

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In the Claims:

1. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, the digital wireless communication system comprising, on a single integrated circuit:

a system bus for transmitting data;

system memory coupled to the system bus for storing code and data;

one or more digital signal processors (DSPs) coupled to the system bus for performing communication functions;

a microcontroller coupled to said system bus which controls operations of said one or more digital signal processors, wherein the microcontroller is configured to access code and data from the system memory, wherein the microcontroller is configured to control operations of the one or more digital signal processors;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled to the system bus which controls arbitration and access to the system bus, wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU;

a CPU local memory coupled to the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations.

2. The digital wireless communication system of claim 1, wherein the bus arbiter is coupled between the system bus and the CPU, wherein the CPU local memory is coupled between the dual port bus arbiter and the CPU, wherein the bus arbiter is a dual port bus arbiter, wherein the dual port bus arbiter is also configured to receive requests from each of the microcontroller and the CPU for access to the CPU local

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memory, wherein the dual port bus arbiter selectively grants access to the CPU local memory to one of either the microcontroller or the CPU.

3. The digital wireless communication system of claim 1, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

4. The digital wireless communication system of claim 1, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

5. The digital wireless communication system of claim 1, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

6. The digital wireless communication system of claim 1, wherein the CPU is operable to access code and data from the CPU local memory while the microcontroller accesses code and data from the system memory.

7. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, comprising, on a single integrated circuit:

a system bus for transmitting code and data;

system memory coupled to the system bus for storing code and data;

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one or more digital signal processors (DSPs) coupled to the system bus for performing communication functions;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled between the system bus and the CPU which controls arbitration and access to the system bus;

a CPU local bus coupled between the CPU and the bus arbiter;

a CPU local memory coupled to the CPU local bus, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations; and

a microcontroller coupled to the CPU local bus which controls operations of said one or more digital signal processors, wherein the microcontroller is configured to access code and data from the CPU local memory, wherein the microcontroller is configured to control operations of the one or more digital signal processors;

wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU.

8. The digital wireless communication system of claim 7, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

9. The digital wireless communication system of claim 7, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

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10. The digital wireless communication system of claim 7, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

11. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, the digital wireless communication system comprising, on a single integrated circuit:

a system bus for transmitting data;

system memory coupled to the system bus for storing code and data;

at least two digital signal processors (DSPs) coupled to the system bus for performing communication functions;

one or more address/data buses coupled between the at least two DSPs for communicating data between the at least two DSPs;

a microcontroller coupled to said system bus which controls operations of said at least two digital signal processors, wherein the microcontroller is configured to access code and data from the system memory, wherein the microcontroller is configured to control operations of the at least two digital signal processors;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled to the system bus which controls arbitration and access to the system bus, wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU;

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a CPU local memory coupled to the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations.

12. The digital wireless communication system of claim 11, wherein the bus arbiter is coupled between the system bus and the CPU, wherein the CPU local memory is coupled between the dual port bus arbiter and the CPU, wherein the bus arbiter is a dual port bus arbiter, wherein the dual port bus arbiter is also configured to receive requests from each of the microcontroller and the CPU for access to the CPU local memory, wherein the dual port bus arbiter selectively grants access to the CPU local memory to one of either the microcontroller or the CPU.

13. The digital wireless communication system of claim 11, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

14. The digital wireless communication system of claim 11, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

15. The digital wireless communication system of claim 11, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

16. The digital wireless communication system of claim 11, further comprising:

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one or more address/data buses coupled between one or more of the DSPs and the CPU for communicating data between one or more of the DSPs and the CPU.

17. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, the digital wireless communication system comprising, on a single integrated circuit:

a system bus for transmitting data;

system memory coupled to the system bus for storing code and data;

a first digital signal processor (DSP) coupled to the system bus for performing communication functions;

a second DSP coupled to the first DSP, wherein the second DSP is not directly connected to the system bus, wherein the first DSP performs system memory accesses to retrieve code and data used by both of the first and second DSPs;

a microcontroller coupled to said system bus which controls operations of said at least two digital signal processors, wherein the microcontroller is configured to access code and data from the system memory, wherein the microcontroller is configured to control operations of the at least two digital signal processors;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled to the system bus which controls arbitration and access to the system bus, wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU;

a CPU local memory coupled to the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations.

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18. The digital wireless communication system of claim 17, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

19. The digital wireless communication system of claim 17, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

20. The digital wireless communication system of claim 17, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

21. A method for performing digital communications functions in a digital communications device comprising a system memory, one or more digital signal processors (DSPs) coupled to the system memory, a microcontroller coupled to the system memory, and a CPU coupled to the system memory, the method comprising:

the CPU writing code and data to the system memory to configure the microcontroller to perform desired functions;

the microcontroller accessing the code and data written by the CPU;

the microcontroller selectively assigning functions to the one or more digital signal processors based on said code and data written by the CPU; and

the one or more digital signal processors performing digital communications functions in response to the microcontroller selectively assigning functions to the one or more digital signal processors.

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22. The method of claim 21, wherein the digital communications device further includes a dual port bus arbiter coupled to the system memory which controls arbitration and access to the system memory, the method further comprising:

the dual port bus arbiter receiving requests from each of the microcontroller and the CPU for access to the system bus; and

the dual port bus arbiter selectively granting control of the system bus to one of either the microcontroller or the CPU.

23. The method of claim 21, wherein the digital communications device further includes a CPU local memory coupled between the dual port bus arbiter and the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations, the method further comprising:

the dual port bus arbiter receiving requests from each of the microcontroller and the CPU for access to the CPU local memory; and

the dual port bus arbiter selectively granting access to the CPU local memory to one of either the microcontroller or the CPU based on said received requests.

24. The method of claim 21, further comprising:

the microcontroller selectively assigning tasks to each of said one or more digital signal processors to attain a desired computational throughput.

25. The method of claim 21, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, the method further comprising:

the microcontroller selectively controlling the clock rates of each of said one or more digital signal processors to reduce power consumption.

26. The method of claim 21, further comprising:

the CPU accessing code and data from the CPU local memory during said microcontroller accessing the code and data written by the CPU.

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27. A system for performing communications according to one of a plurality of different digital standards, comprising:

memory for storing code and data;

a first digital signal processor coupled to the memory for performing transmit functions, wherein the digital signal processor which performs transmit functions performs voice coding functions, channel coding functions, protocol handling functions, and modulation functions;

a second digital signal processor coupled to the memory for performing receive functions, wherein the digital signal processor which performs receive functions performs channel equalization functions and signal estimation functions;

a microcontroller coupled to said first digital signal processor which performs transmit functions and also coupled to said second digital signal processor which performs receive functions, wherein the microcontroller is configured to control operations of the first digital signal processor and the second digital signal processor;

a voice coder/decoder (codec) coupled to each of the first digital signal processor and the second digital signal processor, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic; and

a central processing unit coupled to the memory, wherein the central processing unit implements one of a plurality of possible protocol stacks for digital communication.

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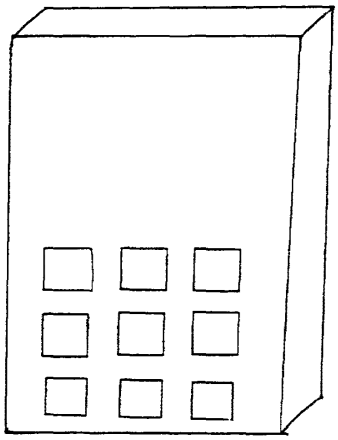


Figure 1

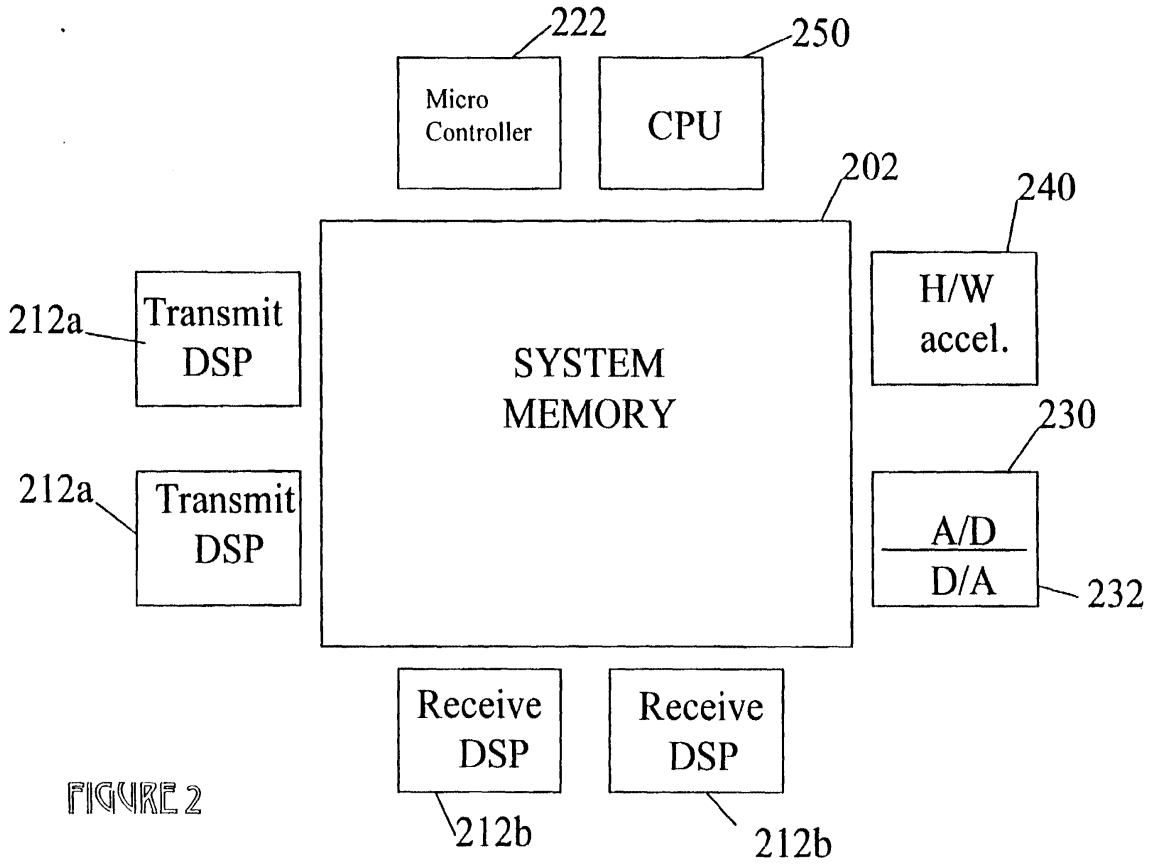

222
250
Micro Controller
CPU
202
240
212a
Transmit DSP
SYSTEM MEMORY
H/W accel.
230
212a
Transmit DSP
A/D
D/A
232
Receive DSP
Receive DSP
212b
212b

FIGURE 2

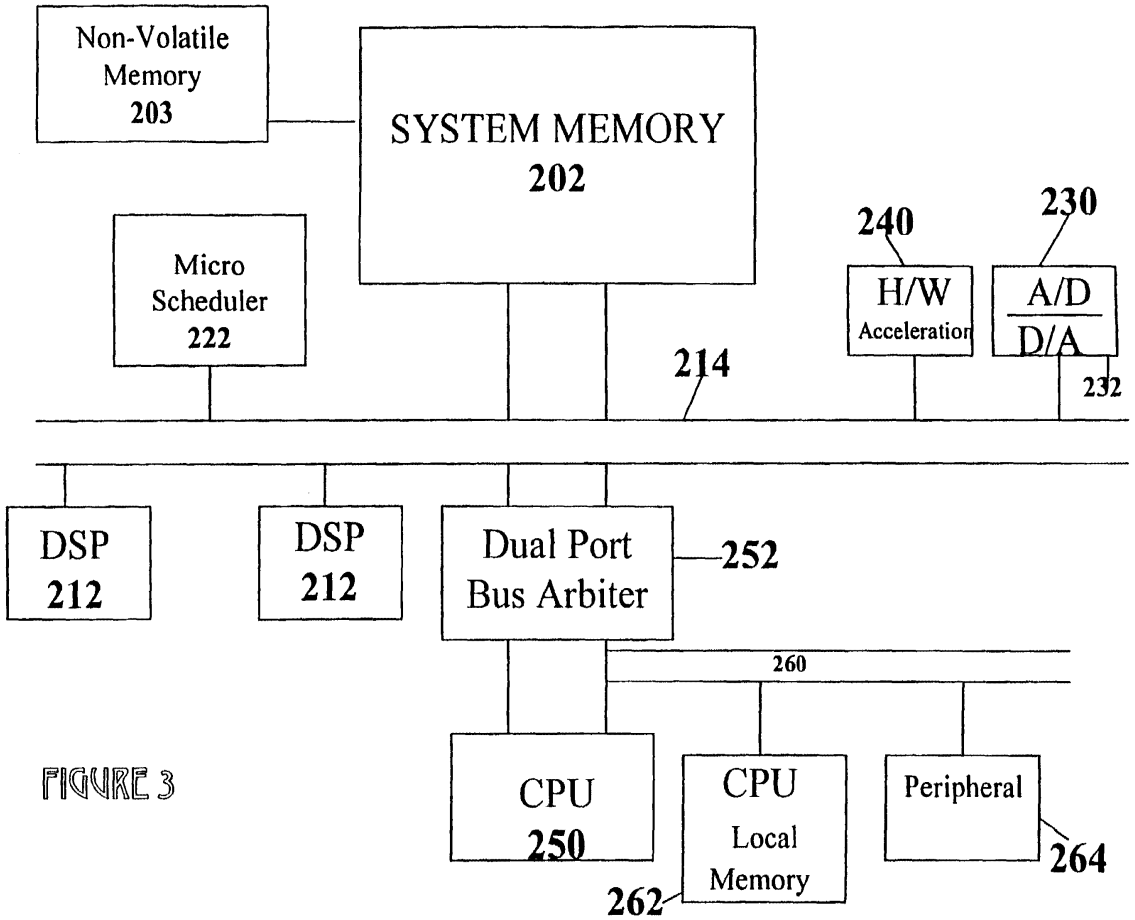

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
230
H/W Acceleration
A/D
D/A
232
214
DSP 212
DSP 212
Dual Port Bus Arbiter
252
260
CPU 250
CPU Local Memory
262
Peripheral
264

FIGURE 3

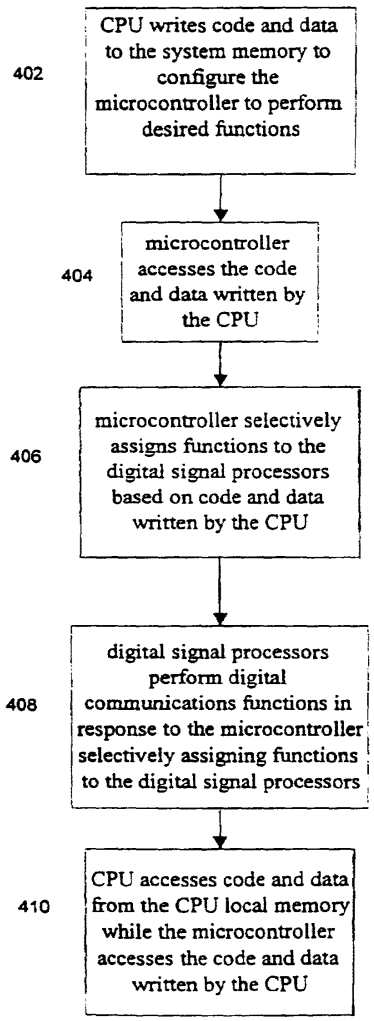

402
CPU writes code and data to the system memory to configure the microcontroller to perform desired functions
404
microcontroller accesses the code and data written by the CPU
406
microcontroller selectively assigns functions to the digital signal processors based on code and data written by the CPU
408
digital signal processors perform digital communications functions in response to the microcontroller selectively assigning functions to the digital signal processors
410
CPU accesses code and data from the CPU local memory while the microcontroller accesses the code and data written by the CPU

Figure 4

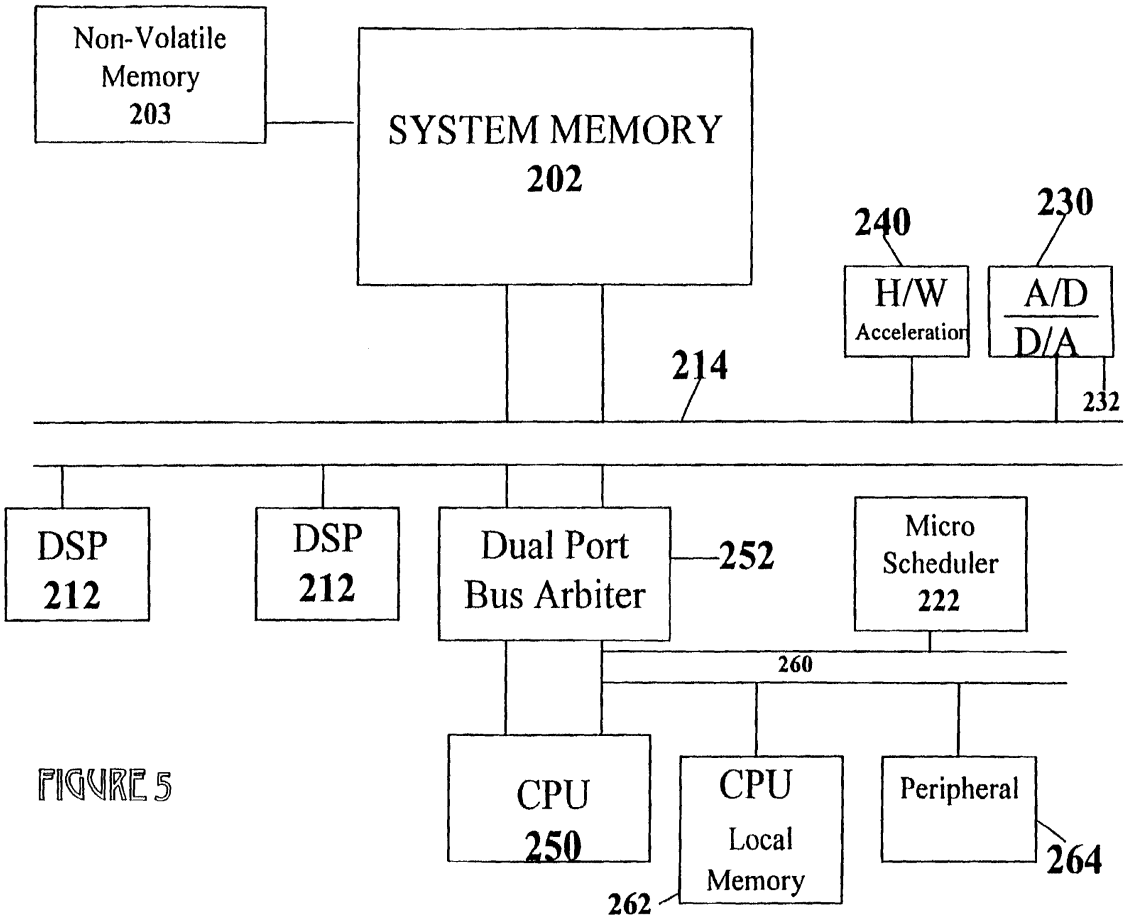

Non-Volatile Memory 203
SYSTEM MEMORY 202
240
H/W Acceleration
230
A/D
D/A
214
232
DSP 212
DSP 212
Dual Port Bus Arbiter
252
Micro Scheduler 222
260
CPU 250
CPU Local Memory
262
Peripheral
264

FIGURE 5

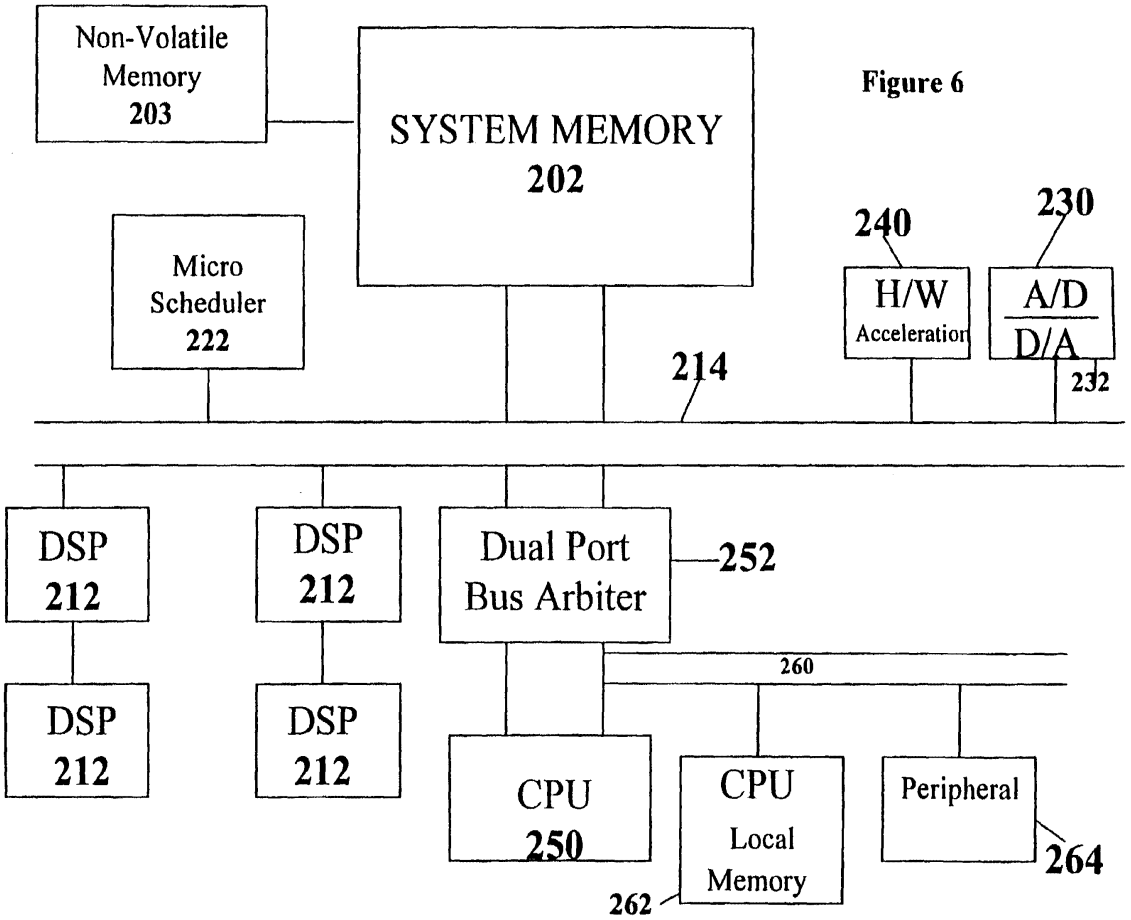

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
H/W Acceleration
230
A/D
D/A
232
214
DSP 212
DSP 212
DSP 212
DSP 212
Dual Port Bus Arbiter
252
260
CPU 250
CPU Local Memory
262
Peripheral
264

Figure 6

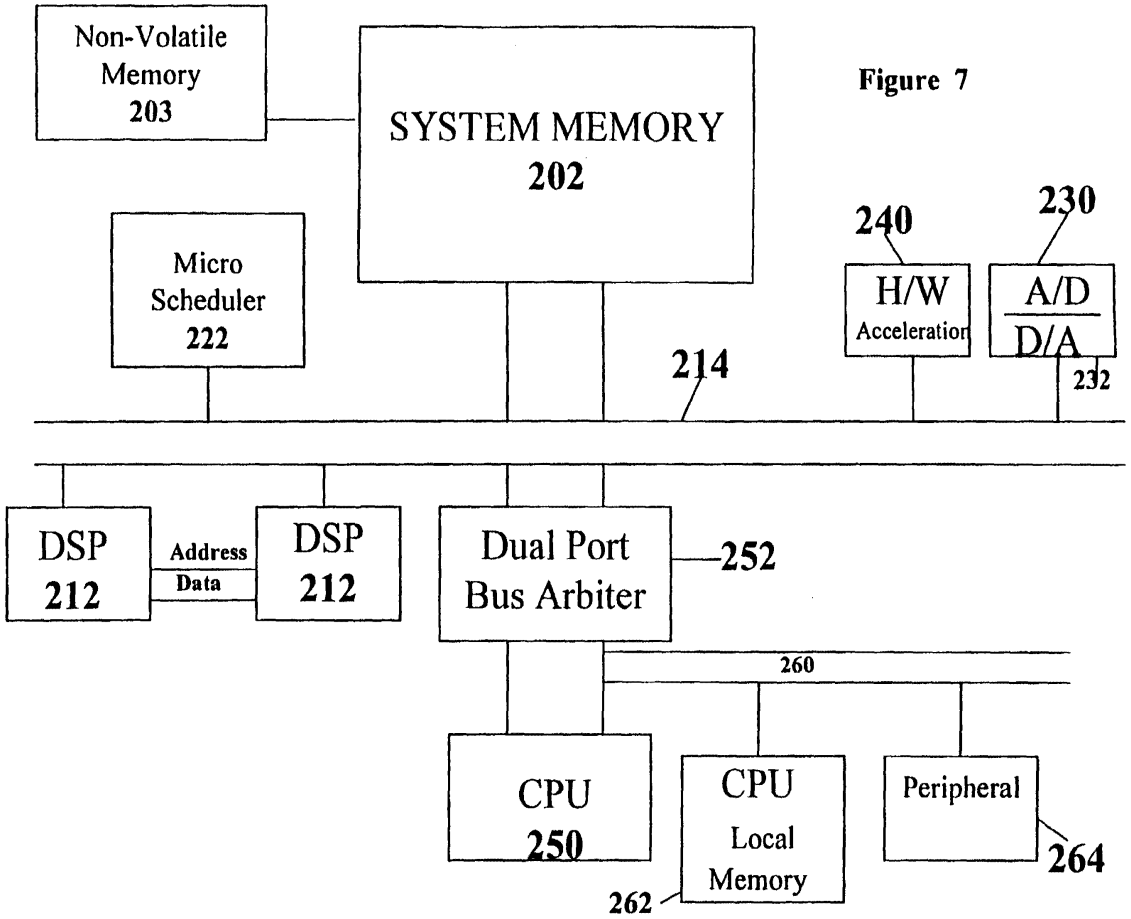

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
H/W Acceleration
230
A/D
D/A
232
214
DSP 212
Address
Data
DSP 212
Dual Port Bus Arbiter
252
260
CPU 250
CPU Local Memory
262
Peripheral
264

Figure 7

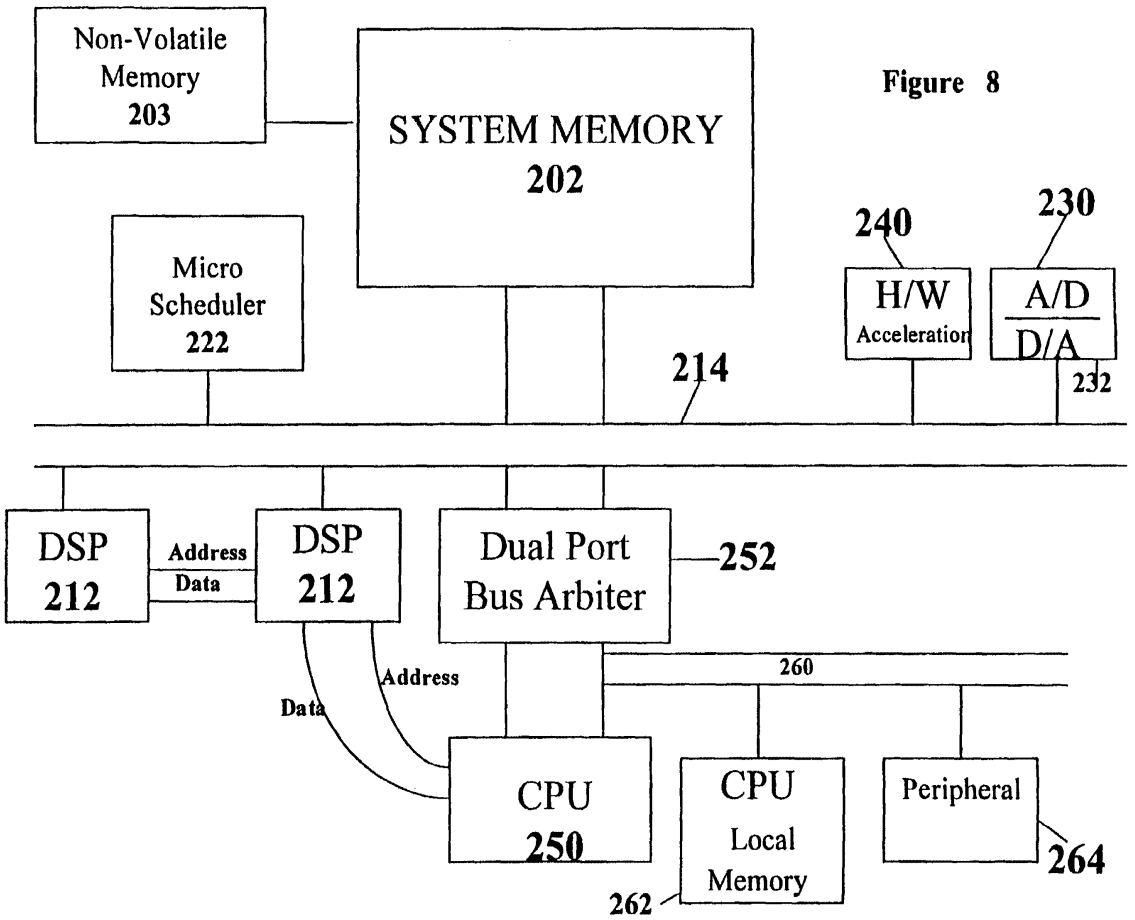

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
H/W Acceleration
230
A/D
D/A
232
214
DSP 212
Address
Data
DSP 212
Dual Port Bus Arbiter
252
260
Address
Data
CPU 250
CPU Local Memory
262
Peripheral
264

Figure 8

INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/US 97/17150

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/32 H04B1/40

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)
IPC 6 H04Q H04B H04M

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 664 632 A (ADVANCED MICRO DEVICES INC) 26 July 1995 see column 1, line 1 - column 6, line 34 see column 8, line 18 - column 16, line 53 see column 18, line 44 - column 19, line 1 see column 20, line 45 - column 21, line 7 see figures 2A,2B	21,24,25
A		1,7,11, 17,27

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in 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 but published on or after the international filing date

"L" document which may throw doubts 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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
11 February 1998	19/02/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Vaskimo, K

Form PCT/ISA/210 (second sheet) (July 1992)

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INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 97/17150

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category '	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	LACKEY R J ET AL: "SPEAKEASY: THE MILITARY SOFTWARE RADIO" IEEE COMMUNICATIONS MAGAZINE, vol. 33, no. 5, 1 May 1995, pages 56-61, XP000518771 see page 56, left-hand column, line 13 - right-hand column, line 33 see page 57, left-hand column, line 46 - right-hand column, line 9 see page 58, left-hand column, line 2 - page 60, line 55 ---	1,7,11, 17,21,27
A	STEELE R ET AL: "THIRD GENERATION PCN AND THE INTELLIGENT MULTIMODE MOBILE PORTABLE" ELECTRONICS AND COMMUNICATION ENGINEERING JOURNAL, vol. 5, no. 3, 1 June 1993, pages 147-156, XP000377790 see abstract see paragraph 1 see paragraph 3 see paragraph 13 ---	1,7,11, 17,21,27
A	EP 0 580 341 A (ADVANCED MICRO DEVICES INC ;SONY CORP (JP)) 26 January 1994 see page 2, line 24 - line 27 see page 3, line 8 - page 4, line 17 see page 5, line 8 - line 11 see page 6, line 8 - page 7, line 20 see page 7, line 56 - page 13, line 33 ---	1,7,11, 17,21,27
A	US 5 465 409 A (BORRAS JAIME A ET AL) 7 November 1995 see the whole document ---	1,7,11, 17,21,27
A	US 4 718 057 A (VENKITAKRISHNAN P ET AL) 5 January 1988 see abstract -----	1,7,11, 17,21,27

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte: onal Application No
PCT/US 97/17150

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0664632 A	26-07-95	US 5483577 A	09-01-96
		JP 7303128 A	14-11-95
EP 0580341 A	26-01-94	US 5555287 A	10-09-96
		CN 1083639 A	09-03-94
		JP 6169280 A	14-06-94
US 5465409 A	07-11-95	CN 1124080 A	05-06-96
		EP 0700626 A	13-03-96
		JP 8510108 T	22-10-96
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		EP 0216488 A	01-04-87
		JP 1924106 C	25-04-95
		JP 6052951 B	06-07-94
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Form PCT/ISA/210 (patent family annex) (July 1992)

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(71) Applicant: **Hand Held Products, Inc.**
Skaneateles Falls, NY 13153 (US)

(72) Inventors:
- **Wang, Ynjiun P**
CUPERTINO, CA 95014 (US)
- **Qu, Huyu**
SAN JOSE, CA 95131 (US)

(74) Representative: **Vuillermoz, Bruno et al**
Cabinet Laurent & Charras
"Le Contemporain"
50, Chemin de la Bruyère
69574 Dardilly Cédex (FR)

(54) **Encoded information reading terminal with wireless path selection capability**

(57) A portable encoded information reading (EIR) terminal for incorporation in a data collection system can comprise a terminal module communicatively coupled to a wireless interface module via a wired interface. The terminal module can include a central processing unit (CPU), a memory, and an encoded information reading (EIR) device. The wireless interface module can include a microcontroller, a memory, and at least one wireless communication interface. The wireless interface module can establish one or more wireless links with one or more peer EIR terminals, to join a wireless network which is collectively formed by the peer EIR terminals. The wireless interface module can receive or transmit beacons containing at least an identifier of a path selection protocol which is used for unicast, multicast and broadcast frame transmission within the wireless network. The wireless interface module, responsive to receiving a MAC frame from the terminal module, can forward the MAC frame, according to the path selection protocol, to a peer EIR terminal or to a portal which is capable of routing MAC frames between the wireless network and one or more OSI layer 2 networks.

BA

EP 2 061 285 A2

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Description

FIELD OF THE INVENTION

[0001] The invention is generally related to data collection systems employing encoded information reading (EIR) terminals and is specifically related to a system and method of wireless data communication in a data collection system employing EIR terminals.

BACKGROUND OF THE INVENTION

[0002] Encoded information reading (EIR) terminals equipped with wireless communication interfaces are widely used in retail stores, shipping facilities, *etc.* While wireless communication of EIR terminals with host computers offer many advantages as compared to wired communications, traditional wireless networks have noticeable shortcomings, including connectivity and network throughput related issues, as well as the high cost of the wireless infrastructure. The connectivity-related issues can be caused, e.g., by "dead zones" created by metal structures and thick reinforced concrete walls within buildings. Network throughput is usually limited by the number and capacity of wireless access points and wireless portals. Attempts to improve the connectivity and throughput by increasing the number of wireless access point invariably lead to substantial growth of the infrastructure roll-out and maintenance costs.

[0003] Further, EIR terminals usually employ a power management scheme according to which a terminal would go to a sleeping state in the absence of any inputs received from the terminal operator. A terminal in a sleeping state is usually not capable of receiving data frames incoming over the terminal's wireless communication interfaces, thus burdening the frame sender with the task of performing frame buffering and retransmission attempts.

[0004] Accordingly, there is a need for further advances in EIR terminals and systems which would alleviate the connectivity, network throughput, power management, and cost-related problems.

SUMMARY OF THE INVENTION

[0005] A portable encoded information reading (EIR) terminal for incorporation in a data collection system can comprise a terminal module communicatively coupled to a wireless interface module via a wired interface. The terminal module can include a central processing unit (CPU), a memory, and an encoded information reading (EIR) device. The wireless interface module can include a microcontroller, a memory, and at least one wireless communication interface. The wireless interface module can establish one or more wireless links with one or more peer EIR terminals, to join a wireless network which is collectively formed by the peer EIR terminals. The wireless interface module can receive or transmit beacons containing at least an identifier of a path selection protocol which is used for unicast, multicast and broadcast frame transmission within the wireless network. The wireless interface module, responsive to receiving a MAC frame from the terminal module, can forward the MAC frame, according to the path selection protocol, to a peer EIR terminal or to a portal which is capable of routing MAC frames between the wireless network and one or more OSI layer 2 networks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] For the purpose of illustrating the invention, the drawings show aspects of one or more embodiments of the invention. However, it should be understood that the present invention is not limited to the precise arrangements and instrumentalities shown in the drawings, wherein:

[0007] Fig. 1 depicts a network-level view of a data collection system employing EIR terminals according to the invention;

[0008] Figs. 2a-2c illustrate a component diagram of an EIR terminal according to the invention;

[0009] Fig. 3 illustrates an example of a network management frame structure according to the invention;

[0010] Fig. 4 illustrates a diagram of power management mode state transitions implemented by an EIR terminal according to the invention;

[0011] Figs. 5a and 5b illustrate an exemplary hand held EIR terminal housing;

[0012] Figs. 6a-6c illustrate an exemplary portable and remountable EIR terminal housing;

[0013] Fig. 7a illustrates a first exemplary deployment of an EIR terminal according to the invention within a retail store;

[0014] Fig. 7b illustrates a second exemplary deployment of an EIR terminal according to the invention within a retail store;

[0015] Figs. 7c and 7d illustrate PIN and signature data entry operational modes of an EIR terminal according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] There is provided a data collection system comprising a plurality of EIR terminals and a plurality of host computers, interconnected by one or more networks. An EIR terminal can include a central processing unit (CPU), an encoded information reading (EIR) device, and at least one wireless communication interface.

[0017] Under the teachings of the prior art, in order to allow Medium Access Control (MAC) frames originated by a wireless communication interface of an EIR terminal to be routed to a host computer which is connected to a non-wireless network, the EIR terminal must be in communication with a wireless portal, the latter routing MAC frames between the wireless network and the non-wireless network. According to the invention, an EIR terminal

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can establish one or more wireless links with one or more peer EIR terminals, in order to join a wireless network which is collectively formed by a plurality of EIR terminals. An EIR terminal can route a MAC frame received from one peer EIR terminal to another peer EIR terminal participating in the wireless network, to a wireless access point (AP) or a portal, so that the MAC frame can finally reach its destination within or outside of the wireless network. Thus, in an environment where there is a number of EIR terminals according to the invention which are active at any given time (e.g., a retail store floor), the requirement that an EIR terminal wishing to establish a wireless communication with a host computer must be within the direct communication range of an AP or a portal, can be eased, since the MAC frames originated by an EIR terminal which is not in the direct communication range of any AP or portal can be routed by one or more peer EIR terminals and/or wireless APs and/or portals to the final destination, which can be within or outside the wireless network. Hence, considerable cost savings can be realized due to the reduced complexity of the required wireless infrastructure. Furthermore, employing EIR terminals according to the invention can lead to the increased range and coverage of the wireless network, since participating EIR terminals can potentially cover larger area than an area that would normally be covered by traditional wireless APs supporting the same number of wireless devices under the teachings of the prior art. Besides, employing EIR terminals according to the invention can lead to an increased overall reliability and throughput of the network, due to potential existence of multiple routes interconnecting participating EIR terminals. Furthermore, employing EIR terminals according to the invention can lead to shortened roll-out periods in establishing a new wireless infrastructure due to the reduced number of wireless APs, portals, and associated cabling which need to be installed.

[0018] An exemplary embodiment of a data collection system according to the invention is shown in Fig. 1. The data collection system 1000 can include EIR terminals 100a-100z interconnected by at least one wireless network 110. In one aspect, the wireless network 110 can act as an OSI layer 2 network implementing IEEE 802.2 Logical Link Control, *i.e.,* can appear to be functionally equivalent to a broadcast Ethernet-based LAN from the perspective of other networks and higher level protocols.

[0019] Now referring to attributes of EIR terminal 100 in further reference to Fig. 2, an EIR terminal 100 according to the invention can have a terminal module 201 and a wireless interface module 202 interconnected by a wired interface 210.

[0020] The terminal module 201 can comprise a central processing unit (CPU) 251 and a memory 252, both coupled to a system bus 259. In one embodiment, the CPU 251 can be provided by a general purpose microprocessor. The terminal module 201 can further comprise one or more encoded information reading (EIR) devices 253, including a bar code reading device, an RFID reading device, and a card reading device, also coupled to the system bus 259. In one embodiment, an EIR reading device can be capable of outputting decoded message data corresponding to an encoded message. In another embodiment, the EIR reading device can output raw message data containing an encoded message, e.g., raw image data or raw RFID data, to be processed by the CPU 251.

[0021] The terminal module 201 can further comprise a keyboard interface 254 and a display adapter 255, both also coupled to the system bus 259.

[0022] The wireless interface module can include a CPU 262 and a memory 261, both coupled to the system bus 269. In one embodiment, the CPU 262 can be provided by a microcontroller. The wireless interface module can further include one or more wireless communication interfaces 265, also coupled to the system bus 269.

[0023] In one embodiment, the EIR terminal 100 can further include a battery 220. Both the terminal module 201 and the wireless interface module 202 can be electrically coupled to the battery 220 via wirings 212a and 212b.

[0024] In another embodiment, each of the terminal module 201 and the wireless interface module 202 can include its own battery. In one dual-battery embodiment, if the wireless interface module battery becomes depleted, the wireless interface module can be powered by the terminal module battery, thus providing for uninterrupted operation of the wireless interface module. In another dual-battery embodiment, if the terminal module battery is depleted, the wireless interface module battery can be used to power the terminal module. Illustrative dual battery embodiments are described in further detail herein *infra.*

[0025] The wireless interface module and the terminal module of an EIR terminal according to the invention can be connected by the wired interface 210, over which the terminal module can transmit outgoing data packets to the wireless interface module. The wired interface 210 can also be employed by the wireless interface module, responsive to receiving by the wireless interface module one or more MAC frames containing one or more data packets addressed to the terminal module, to transmit the data packets to the terminal module.

[0026] Referencing Fig. 1 again, the wireless network 110 can, in one embodiment, include one or more wireless access points (AP) 140a-140b interconnected by a LAN 130. An AP can have at least one wireless communication interface and can transport MAC frames within a network comprising a plurality of EIR terminals and two or more APs interconnected via one or more LANs.

[0027] In another aspect, the data collection system 1000 can further include one or more non-wireless networks (e.g., Ethernet local area networks (LANs)) 170 and 180. LAN 170 can be connected to a wide area network (WAN) 190, e.g., the Internet, via a router 150a. LANs 170 and 180 can be interconnected via a router 150b. LAN 170 can include a plurality of computers 171a-

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171z. LAN 180 can include a plurality of computers 181a-181z.

[0028] The data collection system 1000 can, in one embodiment, further include one or more portals. A portal 120 can route MAC frames between a wireless network 110 and an OSI layer 2 network 170. In one embodiment, the OSI layer 2 network can be a non-wireless, e.g., Ethernet, network. In another embodiment, a portal equipped with two or more wireless interfaces or with one or more multi-channel wireless interfaces can route frames between two or more wireless networks. In one embodiment, at least one access point can be collocated with a portal.

[0029] While different networks are designated herein, it is recognized that a single network as seen from the network layer of the Open System Interconnection (OSI) model can comprise a plurality of lower layer networks, e.g., what can be regarded as a single Internet Protocol (IP) network, can include a plurality of different physical networks.

[0030] The EIR terminals 100a-100z of the data collection system 1000 can be interconnected via wireless links and thus compose a wireless network 110. In one aspect, a wireless interface module of an EIR terminal can join the wireless network 110 by establishing one or more wireless links with one or more peer EIR terminals, with an AP, or with a portal.

[0031] In one aspect, the wireless interface module of an EIR terminal can route, in accordance with a path selection protocol, one or more MAC frames received from a wireless interface module of a peer EIR terminal, an AP or a portal, and not addressed to the wireless interface module or the terminal module of the first EIR terminal. In another aspect, the wireless interface module of an EIR terminal, responsive to receiving one or more data packets from the terminal module of the EIR terminal, can incorporate the data packets into one or more MAC frames and forward the MAC frames in accordance with the path selection protocol.

[0032] The path selection protocol can be used for unicast, multicast and broadcast frame transmission within said wireless network. The path selection protocol can determine a route in accordance to which a MAC frame can be forwarded by a wireless interface module of an EIR terminal to a wireless interface module of a peer EIR terminal participating in the wireless network, to an AP, or to one or more portals, so that the MAC frame can finally reach its destination within or outside of the wireless network.

[0033] In one embodiment, an EIR terminal can further comprise an Ethernet network interface, over which the terminal be connected to the LAN 170 (e.g., when the EIR terminal can be docked to a docking station). Thus the EIR terminal can act as a portal by routing MAC frames received from peer EIR terminals to LAN 170.

[0034] In one embodiment, the path selection protocol can implement pro-active routing. A portal can broadcast a portal announcement containing a link metric (e.g., the number of hops from source to destination, or the round trip time from source to destination). An EIR terminal receiving the portal announcement can increment the link metric and re-broadcast the portal announcement. An EIR terminal receiving the portal announcement can cache the identifiers (e.g., network addresses) of one or more neighboring EIR terminals from which the portal announcement was received. In one aspect, an EIR terminal can periodically transmit route request messages to the neighboring terminals whose identifiers were cached, in order to maintain the path to the portal. In another aspect, if an EIR terminal discovers that a connection is lost to a neighboring terminal whose identifier was previously cached, the EIR terminal can notify the portal which, responsive to the notification, can update its routing information to the notifying EIR terminal.

[0035] Proactive routing can be particularly useful for wireless networks with a relatively large number of fixed infrastructure portals. Proactive routing can provide the routing information in the most efficient manner, by keeping the routing information current and not requiring an EIR terminal to transmit a routing request message before routing a MAC frame, unless no cached routing entries can be found in the EIR terminal routing table. However, in wireless networks which have a smaller number of fixed infrastructure portals and thus are much more dependent on peer EIR terminals for routing MAC frames originated by an EIR terminal, proactive routing can be less effective due to the dynamic nature of the wireless network (spatial movement and on/off switching of EIR terminals) which can lead to cache table entries storing a large number of routes which have become inactive. Thus, in wireless networks built predominantly upon mobile network clients and containing relatively small number of fixed infrastructure portals, the path selection protocol can implement on-demand routing. With on-demand routing, an EIR terminal can transmit route request messages to discover one or more routes from source to destination based on route reply messages received. In one aspect, the routes can be compared to each other based on a pre-defined link metric (e.g., the number of hops from source to destination, or the round trip time from source to destination). In another aspect, the discovered routes can be cached for later re-use.

[0036] In another embodiment, the path selection protocol can implement a hybrid routing method combining on-demand and pro-active routing.

[0037] In one embodiment, only one path selection protocol can be active at any point in time in a wireless network, to ensure that the most optimal path selection protocol is used for a particular wireless network. The only one active path selection protocol limitation can also prevent flooding the wireless network with excessive amount of routing requests and responses, e.g., in a wireless network with a relatively large number of fixed infrastructure portals where a proactive routing-based path selection algorithm is implemented.

[0038] In one aspect, an efficient way of discovering

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the active path selection protocol by an EIR terminal joining a wireless network can be provided by the wireless network management function. The active path selection protocol can be identified by a path selection protocol identifier which can be provided an EIR terminal joining a wireless network together with other network management information.

[0039] In one embodiment, the active path selection protocol identifier can be contained within the network management frames transmitted by a portal, an AP, or a wireless interface module of a peer EIR terminal and received by the wireless interface module of an EIR terminal joining a wireless network.

[0040] A network management frame can be included, e.g., in the beacons periodically transmitted by a portal, an AP, or a wireless interface module of an EIR terminal, and can have a structure shown in Fig. 3. The network management frame 300 can comprise a frame type identifier field 302. The frame type identifier field 302 can contain one of the pre-defined constant values identifying the frame type, e.g., 0x10 for path selection protocol parameters frame. The network management frame 300 can further comprise an active path selection protocol identifier field 304. The active path selection protocol identifier field 304 can contain one of the pre-defined constant values identifying the active path selection protocol, e.g., 0x1001 for Hybrid Wireless Mesh Protocol (HWMP). The network management frame 300 can further comprise a parameter block size field 306. The parameter block size field 306 can contain the size of the parameter block in bytes, e.g., 0x0004. The network management frame 300 can further comprise a path selection protocol parameter block field 308. The path selection protocol parameter block field 308 can contain one or more path selection protocol parameters, e.g., the recommended number of retries for a route request message.

[0041] In one aspect, a wireless network can switch to another path selection protocol to reflect a change in the network topology, e.g., a noticeable increase in the number of EIR terminals participating in a wireless network employing a proactive routing-based path selection protocol, can trigger a transition to an on-demand routing-based path selection protocol which can be more effective in the changed network topology.

[0042] In one embodiment, the features and advantages described herein *supra* can be yielded by an EIR terminal having a wireless interface module acting as an IEEE 802.11 s-conformant mesh point. Hence, a wireless network 110 formed by EIR terminals acting as mesh points can provide a set of IEEE 802.11 s-conformant mesh services, including the management of the mesh and the transport of MAC frames. Mesh paths over the wireless IEEE 802.11 links can be established using a path selection protocol, for the transfer of MAC frames between the EIR terminals participating in the wireless network.

[0043] In one aspect, an EIR terminal can choose to receive and transmit beacons either as defined in the independent basic service set (IBSS) mode of operation or as defined in the infrastructure mode of operation in IEEE 802.11. In the IBSS mode of operation, the EIR terminal can transmit a beacon if a beacon transmitted by another EIR terminal or an AP does not arrive within the beacon period plus a randomly selected short delay. In the infrastructure mode of operation, the EIR terminal can transmit beacons periodically, with a pre-defined time interval.

[0044] In another aspect, an EIR terminal can implement a beacon collision avoidance mechanism in order to reduce the chance that the terminal would transmit a beacon frame at the same time as one of neighboring peer terminals, portals, or APs. In one embodiment, an EIR terminal can implement a beacon collision avoidance mechanism defined in IEEE 802-11s standard. A terminal can select a target beacon transmission time (TBTT) that does not conflict with the neighboring peer terminals, portals or APs. An EIR terminal can adjust its timing synchronization function (TSF) timer if the terminal discovers that its TBTT can collide with the TBTT of a neighboring peer terminal, a portal or an AP. An EIR terminal can also occasionally delay its beacon frames by a pseudo-random period of time. A skilled artisan would appreciate the fact that other beacon collision avoidance mechanisms implemented by an EIR terminal are within the scope and spirit of the invention.

[0045] In a further aspect, the EIR terminal can implement an IEEE 802.11s-conformant path selection protocol, e.g., the Hybrid Wireless Mesh Protocol (HWMP). In one embodiment, the EIR terminal can further implement a Radio-Aware Optimized Link State Routing (RA-OLSR) protocol.

[0046] In another aspect, an EIR terminal can support IEEE 802.11-conformant wireless station services, including authentication, deauthentication, privacy, and MAC service data unit (MSDU) delivery. Each of the services is briefly described herein *infra*.

[0047] Authentication: Physical security can not be effectively employed to prevent unauthorized access to a wireless network since the wireless medium does not have precise bounds. IEEE 802.11 provides the ability to control network access via the authentication service. This service can be used by all wireless devices to establish their identity to other wireless devices with which they communicate. IEEE 802.11 supports several authentication processes, but does not mandate the use of any particular authentication scheme. IEEE 802.11 provides link-level authentication between IEEE 802.11 wireless devices, e.g., a shared key authentication. In a shared key authentication system, identity is demonstrated by knowledge of a shared secret encryption key.

[0048] Deauthentication: The deauthentication service is invoked whenever an existing authentication is to be terminated.

[0049] Privacy: Any IEEE 802.11-conformant wireless device may hear all IEEE 802.11 traffic that is within its radio range. Thus the connection of a single wireless link

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(without privacy) to an existing wired LAN may seriously degrade the security level of the wired LAN. To bring the functionality of the wireless LAN up to the level implicit in wired LAN design, IEEE 802.11 provides the ability to encrypt the contents of MAC frames. This functionality is provided by the privacy service. IEEE 802.11 specifies an optional privacy algorithm, Wired Equivalent Privacy (WEP), which is designed to satisfy the goal of wired LAN "equivalent" privacy.

[0050] In one embodiment, an EIR terminal can further support IEEE 802.11-conformant distribution system services, including association, disassociation, distribution, integration, and reassociation, and thus act as an AP. Each of the services is briefly described herein *infra.*

[0051] Association: To deliver a MAC frame within a wireless network, the distribution service needs to know which access point (AP) or portal to access for the given wireless device. This information can be provided by the association service. Before a wireless device is allowed to transmit a MAC frame via an AP or a portal, it shall first become associated with the AP or the portal. At any given time, a wireless device can be associated with no more than one AP or portal. An AP or a portal may be associated with many wireless devices at one time.

[0052] Disassociation: The disassociation service is invoked whenever an existing association is to be terminated. The disassociation service may be invoked by either party to an association (wireless device or AP).

[0053] Distribution: the distribution service delivers the MAC frame within a wireless network to the intended recipients.

[0054] Integration: If the distribution service determines that the intended recipient of a MAC frame is on a network integrated with the wireless network where the MAC frame originates, the MAC frame will need to be routed via a portal instead of an AP. The integration function is responsible for accomplishing whatever is needed to deliver a MAC frame to the integrated network.

[0055] Reassociation: Association is sufficient for no-transition MAC frame delivery between IEEE 802.11 devices. Additional functionality is needed to support device transition mobility. The additional required functionality is provided by the reassociation service which is invoked to "move" a current association from one AP to another.

[0056] Power management control implemented by an EIR terminal according to the invention is now described. In one aspect, the terminal module and the wireless interface module of an EIR according to the invention each can have associated power management logic control and each can operate in power save mode. Power management logic control of the terminal module can control the power consumption states of the terminal module between at least terminal module awake and terminal module sleeping states. In one embodiment, power management logic control of the wireless interface module can control the power consumption states of the wireless interface module between at least a wireless interface module awake and a wireless interface module sleeping states. In another embodiment, the wireless interface module can continuously operate in the wireless interface module awake state, e.g., by suspending the power management control functionality, or by having no power management control.

[0057] The EIR terminal according to the invention can be configured so that differentiated sleeping states of the terminal module and the wireless interface module can be active at a given time.

[0058] Terminal module 201 operating in power save mode can switch into the terminal module sleeping state, e.g., upon expiration of a pre-defined timeout since the last interaction with the terminal operator. In one illustrative example the EIR terminal is capable of operating in a mode in which the wireless interface module is in a wireless interface module awake state while the terminal module is in a terminal module sleeping state, so that the EIR terminal conserves power without disrupting the operation of the wireless interface module as a routing node of a wireless mesh network.

[0059] In the terminal module sleeping state, the peripheral devices of the terminal module (e.g., a display) can be powered down. The CPU of the terminal module can be halted (e.g., by the HLT instruction for Intel® x86 family of processors), and thus driven into a reduced power consumption mode.

[0060] Terminal module 201 can transition from the terminal module sleeping state to the terminal module awake state upon receiving an input via a user interface. The input can in turn trigger a hardware interrupt causing the terminal module CPU to resume processing. In another embodiment, a hardware interrupt awakening the terminal module CPU can be triggered by a wireless interface module signaling over the wired interface 210 that a data frame addressed to the PDT has been received, thus causing the terminal module 201 to transition from the terminal module sleeping state to the terminal module awake state responsive to receiving a data frame from the wireless interface module 202 over the wired interface 210.

[0061] A skilled artisan would appreciate the fact that other mechanisms of a CPU entering/exiting a low power consumption state are within the scope and the spirit of the invention.

[0062] The wireless interface module 202 power management functionality is now described. In one embodiment, the wireless interface module power save state transitions can be differentiated from the current power save state of the terminal module, e.g., the terminal module can be in the terminal module sleeping state while the wireless interface module is in the wireless interface module awake state, so that power is conserved by the EIR terminal without disrupting participation of the wireless interface module in a wireless mesh network. In another aspect, the terminal module can be in the terminal module awake state while the wireless interface module is in the wireless interface module sleeping state. In a further aspect, the wireless interface module and the ter-

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minal module can be in the wireless interface module awake state and the terminal module awake state, respectively. In a further aspect, the wireless interface module and the terminal module can be in the wireless interface module sleeping state and the terminal module sleeping state, respectively.

[0063] In one aspect, the wireless interface module responsive to receiving one or more MAC frames containing at least one data packet addressed to the terminal module can transmit the data packet to the terminal module over the wired interface 210, thus triggering a hardware interrupt which can cause the terminal module to transition to the terminal module awake state, if the terminal module was in the terminal module sleeping state. In another aspect, the wireless interface module in the wireless interface module sleeping state can transition to the wireless interface module awake state responsive to receiving a data packet from the terminal module over the wired interface 210.

[0064] In another embodiment, the wireless interface module can continuously operate in the wireless interface module awake state, e.g., by suspending the power management control functionality, or by having no power management control.

[0065] Fig. 4 illustrates a diagram of power management mode state transitions that can be implemented by the terminal module and the wireless interface module of an EIR terminal according to the invention.

[0066] Terminal module 201 of the EIR terminal 100 can implement a power management scheme, according to which the terminal module would transition from terminal module awake state 410 to terminal module sleeping state 420 upon expiration of a pre-defined timeout since the last interaction with the terminal operator (state transition 412). The terminal module 201 can remain in the terminal module sleeping state 420 until one of the two events occurs which would cause the terminal module 201 to transition to the terminal module awake state 410: a user interface interaction (state transition 414) or a data frame received from the wireless interface module 202 (state transition 416).

[0067] Wireless interface module 202 of the EIR terminal 100 can implement a power management scheme, according to which the wireless interface module would transition from wireless interface module awake state 430 to the wireless interface module sleeping state 440 upon satisfaction of one of the state transition conditions specified in IEEE 802.11 (state transition 432). The wireless interface module 202 can remain in the wireless interface module sleeping state 440 until one of the events occurs which would cause the wireless interface module 202 to transition to the wireless interface module awake state 430: satisfaction of one of the state transition conditions specified in IEEE 802.11 (state transition 434) or a data frame received from the terminal module 202 (state transition 436).

[0068] Battery optimization functionality of the EIR terminal according to the invention is now described. In one embodiment shown in Fig. 2a, the EIR terminal 100 can include a battery 220 supplying AC power to both terminal module 201 and wireless interface module 202, which can be electrically coupled to the battery 220 via respective wirings 212a and 212b. In another embodiment, each of the terminal module 201 and wireless interface module 202 can include its own battery.

[0069] In one dual-battery embodiment shown in Fig. 2b, the terminal module 201 can be electrically coupled to the terminal module battery 220a via wirings 212a, and the wireless interface module 202 can be electrically coupled to the switch 214. In a normal operation, the switch can electrically couple the wireless interface module 202 to the wireless interface module battery 220b via wirings 212b. If the wireless interface module battery 220b becomes depleted, the switch 214 can switch the wireless interface module 202 to the terminal module battery 220a via wirings 212c, thus providing for uninterrupted operation of the wireless interface module.

[0070] In another dual-battery embodiment shown in Fig. 2c, both the terminal module 201 and the wireless interface module 202 can be electrically coupled to the switch 214. The switch 214, in turn, can be electrically coupled to both the terminal module battery 220a and the wireless interface module battery 220b. In a normal operation, the switch can electrically couple the wireless interface module 202 to the wireless interface module battery 220b via wirings 212c, and electrically couple the terminal module 201 to the terminal module battery via wirings 212d. If the wireless interface module battery 220b becomes depleted, the switch 214 can switch the wireless interface module 202 to the terminal module battery 220a via wirings 212d, thus providing for uninterrupted operation of the wireless interface module. If the terminal module battery 220a becomes depleted, the switch 214 can switch the terminal module 201 to the wireless interface module battery 220b via wirings 212c, thus providing for uninterrupted operation of the terminal module.

[0071] In one embodiment, the switch 214 can be configured to operate in a fully automatic switching mode, by performing the switching functionality described *supra* based upon monitoring, e.g., the voltage levels of batteries 220a and 220b. In another embodiment, the switch 214 can be controllable by the EIR terminal operator, e.g., via a graphical user interface (GUI). In a further embodiment, the switch can be controllable by a software program executed by the CPU 251.

[0072] Form factors and housings for the EIR terminal according to the invention are now being described. The components of device 100 can be incorporated into a variety of different housings. As indicated by the embodiment of Figs. 5a and 5b, the components of Figs. 2a and 2b can be incorporated into a hand held housing 101. EIR terminal 100 of Figs. 5a and 5b is in the form factor of a hand held portable data terminal. EIR terminal 100 as shown in Figs. 5a and 5b includes a keyboard 1090, a display 504 having an associated touch screen overlay, a card reader 1348, and an imaging module 360 which

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includes the components of imaging assembly as described herein; namely, image sensor array incorporated on an image sensor IC chip. Imaging module 360 has an associated imaging axis, a_i. As indicated by the side view of Fig. 5b, the components of the block diagram of Figs. 2a and 2b may be supported within housing 101 on a plurality of circuit boards 1077. Imaging module 360 may include an image sensor array having color sensitive pixels as described in Provisional Patent Application Nos. 60/687,606, filed June 3, 2005, 60/690,268, filed June 14, 2005, 60/692,890, filed June 22, 2005, and 60/694,371, filed June 27, 2005, all of which are entitled Digital Picture Taking Optical Reader Having Hybrid Monochrome And Color Image Sensor, and all of which are incorporated herein by reference.

[0073] In the embodiment of Figs. 6a-6c, the EIR terminal 100 is in the form of a transaction terminal which may be configured as a retail purchase transaction terminal or as a price verifier. Housing 102 of the transaction terminal shown in Figs. 6a-6c is configured to be portable so that it can be moved from location to location and is further configured to be replaceably mounted on a fixed structure such as a fixed structure of a cashier station or a fixed structure of the retail store floor (e.g., a shelf, a column 264 best viewed in Fig. 7b). Referring to bottom view of Fig. 6c, the housing 102 of the EIR terminal 100 has formations 268 facilitating the replaceable mounting of EIR terminal 100 on a fixed structure. Referring now to Fig. 6b, EIR terminal 100 includes a display 504 having an associated touch screen 504T, a card reader 1348, an imaging module 360, and a luminous shroud 362. When light from the illumination block (not shown in Fig. 6) strikes luminous shroud 362, the shroud glows to attract attention to the location of imaging assembly. In certain operating modes as indicated in Fig. 7c, the EIR terminal 100 in accordance with any of Figs. 5a-6c, displays on display 504 a PIN entry screen prompting a customer to enter PIN information into touch screen 504T. In other operating modes, as indicated in Fig. 7d, the EIR terminal 100 displays on display 504 a signature prompt screen prompting a customer to enter signature information into the device with use of a stylus 505.

[0074] Referring to Figs. 7a and 7b, various installation configurations for the EIR terminal of Figs. 5a-6c are shown. In the view of Fig. 7a, the EIR terminal 100 is installed as a retail purchase transaction terminal at a point of sale cashier station. In the setup of Fig. 7a, the EIR terminal 100 is configured as a retail purchase transaction terminal and is utilized to aid and facilitate retail transactions at a point of sale. A customer may enter a credit card or a debit card into card reader 1348 and retail purchase transaction terminal 100R may transmit the credit card information to credit/debit authorization network.

[0075] In the view of Fig. 7b, the EIR terminal 100 is configured as a price verifier to aid customers in checking prices of products located on a store floor. EIR terminal 100 may be mounted on a shelf (not shown in Fig. 7b) or on a column 264 or other fixed structure of the retail store. EIR terminal 100 may decode bar code data from bar codes on store products and transmit decoded out bar code messages to a store server for lookup of price information which is sent back from the store server to terminal 100 for display on display 504.

[0076] By combining a terminal module and a wireless interface module within a single EIR terminal according to the invention, all the advantages accorded by employing wireless EIR terminals can be fully realized, and the cost of deploying and supporting of the wireless infrastructure can be dramatically decreased, by minimizing the number of wireless APs and portals needed to provide the wireless connectivity to a fleet of portable EIR terminals. Furthermore, employing EIR terminals according to the invention can increase the range of wireless network coverage as compared to traditional wireless network with fixed APs and portals, as well as improve the network reliability since a mesh network can provide multiple network paths connecting any given wireless EIR terminal to an AP, a portal, or a peer EIR terminal. The availability of multiple network paths can also cause increasing of the overall network throughput.

[0077] While the present invention has been particularly shown and described with reference to certain exemplary embodiments, it will be understood by one skilled in the art that various changes in detail may be affected therein without departing from the spirit and scope of the invention as defined by claims that can be supported by the written description and drawings. Further, where exemplary embodiments are described with reference to a certain number of elements it will be understood that the exemplary embodiments can be practiced utilizing less than the certain number of elements.

[0078] A small sample of systems methods and apparatus that are described herein is as follows:

A1. There is provided a portable encoded information reading (EIR) terminal for incorporation in a data collection system having a plurality of peer EIR terminals, said plurality of peer EIR terminal collectively forming a wireless network, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network, said EIR terminal comprising: a terminal module including a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message; and a wireless interface module communicatively coupled to said terminal module via a wired

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interface, said wireless interface module including a microcontroller, a memory, and at least one wireless communication interface; wherein said wireless interface module establishes one or more wireless links with one or more EIR terminals of said plurality of peer EIR terminals, to join said wireless network; wherein said wireless interface module performs at least one of:
receiving beacons, transmitting beacons, said beacons containing at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network; wherein said wireless interface module, responsive to receiving one or more data packets from said terminal module, incorporates said one or more data packets into one or more MAC frames and forwards said one or more MAC frames, according to said path selection protocol, to one of: a peer EIR terminal, a wireless access point, one or more of said portals; and wherein said wireless interface module, responsive to receiving one or more MAC frames, said one or more MAC frames containing one or more data packet addressed to said terminal module, transmits said one or more data packets to said terminal module.

A2. There is also provided the EIR terminal of (A1), wherein said receiving beacons and transmitting beacons is performed according to one of: IEEE 802.11 Independent Basic Service Set (IBSS) mode of operation, IEEE 802.11 infrastructure mode of operation.

A3. There is also provided the EIR terminal of (A1), wherein said wireless interface module performs IEEE 802.11-conformant wireless station services including authentication, de-authentication, privacy, and MAC service data unit delivery; and wherein said wireless interface module further performs IEEE 802.11-conformant wireless distribution system services including association, disassociation, distribution, integration, and re-association.

A4. There is also provided the EIR terminal of (A1), wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state; wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; and wherein said EIR terminal is capable of operating in a mode in which said terminal module is in said terminal module sleeping state and said wireless interface module is in said wireless interface module awake state in such manner that power is conserved by said EIR terminal without disrupting participation of said wireless interface module in said mesh network.

A5. There is also provided the EIR terminal of (A1), wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state; wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; and wherein said wireless interface module causes said terminal module to exit said terminal module sleeping state by transmitting at least one data packet to said terminal module.

A6. There is also provided the EIR terminal of (A1), wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state; wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; and wherein said terminal module causes said wireless interface module to exit said wireless interface module sleeping state by transmitting at least one data packet to said wireless interface module.

A7. There is also provided the EIR terminal of (A1), wherein said terminal module includes a first battery; wherein said wireless interface module includes a second battery; and wherein said first battery is used to power said wireless interface module responsive to said second battery depletion, thus providing for uninterrupted operation of said wireless interface module.

A8. There is also provided the EIR terminal of (A1), wherein said path selection protocol is the only path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

B1. In addition, there is provided a portable encoded information reading (EIR) terminal for incorporation in a data collection system having a plurality of peer EIR terminals, said plurality of peer EIR terminal collectively forming a wireless network, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access

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points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network, said EIR terminal comprising: a terminal module including a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message; and a wireless interface module communicatively coupled to said terminal module via a wired interface, said wireless interface module including a microcontroller, a memory, and at least one wireless communication interface; wherein said wireless interface module establishes one or more wireless links with one or more EIR terminals of said plurality of peer EIR terminals, to join said wireless network; wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state; wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; and wherein said EIR terminal is capable of operating in a mode in which said terminal module is in said terminal module sleeping state and said wireless interface module is in said wireless interface module awake state in such manner that power is conserved by said EIR terminal without disrupting participation of said wireless interface module in said mesh network.

B2 There is also provided the EIR terminal of (B1), wherein said wireless interface module performs at least one of: receiving beacons, transmitting beacons, said beacons containing at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

B3. There is also provided the EIR terminal of (B1), wherein said wireless interface module, responsive to receiving one or more data packets from said terminal module, incorporates said one or more data packets into one or more MAC frames and forwards said one or more MAC frames to one of: a peer EIR terminal, a wireless access point, one or more of said portals.

B4. There is also provided the EIR terminal of (B1), wherein said wireless interface module, responsive to receiving one or more MAC frames, said one or more MAC frames containing one or more data packet addressed to said terminal module, transmits said one or more data packets to said terminal module.

B5. There is also provided the EIR terminal of (B1), wherein said wireless interface module performs IEEE 802.11-conformant wireless station services including authentication, de-authentication, privacy, and MAC service data unit delivery; and wherein said wireless interface module further performs IEEE 802.11-conformant wireless distribution system services including association, disassociation, distribution, integration, and re-association.

B6. There is also provided the EIR terminal of (B1), wherein said wireless interface module continuously operates in said wireless interface module awake state.

C1. In addition, there is provided a portable encoded information reading (EIR) terminal for incorporation in a data collection system having a plurality of peer EIR terminals, said plurality of peer EIR terminal collectively forming a wireless network, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network, said EIR terminal comprising: a terminal module including a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message; and a wireless interface module communicatively coupled to said terminal module via a wired interface, said wireless interface module including a microcontroller, a memory, and at least one wireless communication interface; wherein said wireless interface module establishes one or more wireless links with one or more EIR terminals of said plurality of peer EIR terminals, to join said wireless network; wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state; wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; wherein said wireless interface module causes said terminal module to exit said terminal module sleeping state by transmitting

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at least one data packet to said terminal module; and wherein said terminal module causes said wireless interface module to exit said wireless interface module sleeping state by transmitting at least one data packet to said wireless interface module.

C2. There is also provided the EIR terminal of (C1), wherein said wireless interface module performs at least one of: receiving beacons, transmitting beacons, said beacons containing at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

C3. There is also provided the EIR terminal of (C1), wherein said wireless interface module, responsive to receiving one or more data packets from said terminal module, incorporates said one or more data packets into one or more MAC frames and forwards said one or more MAC frames to one of: a peer EIR terminal, a wireless access point, one or more of said portals.

C4. There is also provided the EIR terminal of (C1), wherein said wireless interface module, responsive to receiving one or more MAC frames, said one or more MAC frames containing one or more data packet addressed to said terminal module, transmits said one or more data packets to said terminal module.

C5. There is also provided the EIR terminal of (C1), wherein said wireless interface module performs IEEE 802.11-conformant wireless station services including authentication, de-authentication, privacy, and MAC service data unit delivery; and wherein said wireless interface module further performs IEEE 802.11-conformant wireless distribution system services including association, disassociation, distribution, integration, and re-association.

D1. In addition, there is provided a portable encoded information reading (EIR) terminal for incorporation in a data collection system having a plurality of peer EIR terminals, said plurality of peer EIR terminal collectively forming a wireless network, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network, said EIR terminal comprising: a terminal module including a first battery, a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message; and a wireless interface module communicatively coupled to said terminal module via a wired interface, said wireless interface module including a second battery, a microcontroller, a memory, and at least one wireless communication interface; wherein said wireless interface module establishes one or more wireless links with one or more EIR terminals of said plurality of peer EIR terminals, to join said wireless network; and wherein said first battery is used to power said wireless interface module responsive to said second battery depletion, thus providing for uninterrupted operation of said wireless interface module.

D2. There is also provided the EIR terminal of (D1), wherein said wireless interface is electrically coupled to a switching means; wherein in a normal operation, said switching means electrically couple said wireless interface module to said second battery; and wherein said switching means conditionally, upon depletion of said second battery, electrically couple said wireless interface module to said first battery.

D3. There is also provided the EIR terminal of (D1), wherein said wireless interface is electrically coupled to a switching means; wherein in a normal operation, said switching means electrically couple said terminal module to said first battery; and wherein said switching means conditionally, upon depletion of said first battery, electrically couple said terminal module to said second battery.

D4. There is also provided the EIR terminal of (D1), wherein said wireless interface module performs at least one of: receiving beacons, transmitting beacons, said beacons containing at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

D5. There is also provided the EIR terminal of (D1), wherein said wireless interface module performs IEEE 802.11-conformant wireless station services including authentication, de-authentication, privacy, and MAC service data unit delivery; wherein said wireless interface module further performs IEEE 802.11-conformant wireless distribution system services including association, disassociation, distribution, integration, and re-association.

E1. In addition, there is provided a data collection system comprising a plurality of encoded information reading (EIR) terminals, each of said EIR terminals comprising a terminal module including a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an

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RFID reading device, and a card reading device, said EIR device configured to perform one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message; each of said EIR terminals further comprising a wireless interface module communicatively coupled to said terminal module via a wired interface, said wireless interface module including a CPU, a memory, and at least one wireless communication interface; wherein said plurality of EIR terminals collectively form a wireless network in which each EIR terminal is directly connected via a wireless link to one or more peer EIR terminals, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network; wherein said wireless interface modules of at least three EIR terminals of said plurality of EIR terminals performs at least one of: receiving beacons, transmitting beacons, said beacons containing at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network; wherein a wireless interface module of a first EIR terminal, responsive to receiving one or more MAC frames from a wireless interface module of a second EIR terminal, said one or more MAC frames containing one or more data packet addressed to said terminal module of said first EIR terminal, transmits said one or more data packets to said terminal module of said first EIR terminal; and wherein a wireless interface module of a first EIR terminal, responsive to receiving one or more MAC frames from a wireless interface module of a second EIR terminal, said one or more MAC frames not addressed to said wireless interface module or said terminal module of said first EIR terminal, forwards said one or more MAC frames, according to said path selection protocol, to one of: a wireless interface module of a third EIR terminal, a wireless access point, one or more of said portals.

E2. There is also provided the data collection system of (E1), wherein said wireless interface modules of said at least three EIR terminals of said plurality of EIR terminals perform IEEE 802.11-conformant wireless station services including authentication, de-authentication, privacy, and MAC service data unit delivery; and wherein said wireless interface modules of said at least three EIR terminals of said plurality of EIR terminals further perform IEEE 802.11-conformant wireless distribution system services including association, disassociation, distribution, integration, and re-association.

E3. There is also provided the data collection system of (E1), wherein wireless interface module performs IEEE 802.11-conformant wireless station services including authentication, de-authentication, privacy, and MAC service data unit delivery; and wherein said wireless interface module further performs IEEE 802.11-conformant wireless distribution system services including association, disassociation, distribution, integration, and re-association.

E4. There is also provided the data collection system of (E1), wherein at least one said wireless access point is collocated with at least one said portal.

E5. There is also provided the data collection system of (E1), wherein a first EIR terminal further comprises an Ethernet network interface, said first EIR terminal connecting to a local area network (LAN) over said Ethernet network interface; and wherein said first EIR terminal, responsive to receiving one or more MAC frames from a wireless interface module of a second EIR terminal, said one or more MAC frames not addressed to said wireless interface module or said terminal module of said first EIR terminal, forwards said one or more MAC frames to said LAN via said Ethernet network interface.

E6. There is also provided the data collection system of (E1), wherein said path selection protocol is the only path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

[0079] While the present invention has been described with reference to a number of specific embodiments, it will be understood that the true spirit and scope of the invention should be determined only with respect to claims that can be supported by the present specification. Further, while in numerous cases herein systems and apparatuses and methods are described as having a certain number of elements, it will be understood that such systems, apparatuses and methods can be practiced with fewer than the mentioned certain number of elements.

Claims

1. A portable encoded information reading (EIR) terminal for incorporation in a data collection system having a plurality of peer EIR terminals, said plurality of peer EIR terminal collectively forming a wireless network, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network, said EIR ter-

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minal comprising :

- a terminal module including a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message; and
- a wireless interface module communicatively coupled to said terminal module via a wired interface, said wireless interface module including a microcontroller, a memory, and at least one wireless communication interface;

wherein said wireless interface module establishes one or more wireless links with one or more EIR terminals of said plurality of peer EIR terminals, to join said wireless network;
wherein said wireless interface module performs at least one of: receiving beacons, transmitting beacons, said beacons containing at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network;
wherein said wireless interface module, responsive to receiving one or more data packets from said terminal module, incorporates said one or more data packets into one or more MAC frames and forwards said one or more MAC frames, according to said path selection protocol, to one of: a peer EIR terminal, a wireless access point, one or more of said portals; and
wherein said wireless interface module, responsive to receiving one or more MAC frames, said one or more MAC frames containing one or more data packet addressed to said terminal module, transmits said one or more data packets to said terminal module.

2. The EIR terminal of claim 1, wherein said receiving beacons and transmitting beacons is performed according to one of: IEEE 802.11 Independent Basic Service Set (IBSS) mode of operation, IEEE 802.11 infrastructure mode of operation.

3. The EIR terminal of claim 1, wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state;
wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; and
wherein said EIR terminal is capable of operating in a mode in which said terminal module is in said terminal module sleeping state and said wireless interface module is in said wireless interface module awake state in such manner that power is conserved by said EIR terminal without disrupting participation of said wireless interface module in said mesh network.

4. The EIR terminal of claim 1, wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state;
wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; and
wherein said wireless interface module causes said terminal module to exit said terminal module sleeping state by transmitting at least one data packet to said terminal module.

5. The EIR terminal of claim 1, wherein said terminal module includes a first battery;
wherein said wireless interface module includes a second battery; and
wherein said first battery is used to power said wireless interface module responsive to said second battery depletion, thus providing for uninterrupted operation of said wireless interface module.

6. The EIR terminal of claim 1, wherein said path selection protocol is the only path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

7. A portable encoded information reading (EIR) terminal for incorporation in a data collection system having a plurality of peer EIR terminals, said plurality of peer EIR terminal collectively forming a wireless network, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network, said EIR terminal comprising:

- a terminal module including a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform

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one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message;

- a wireless interface module communicatively coupled to said terminal module via a wired interface, said wireless interface module including a microcontroller, a memory, and at least one wireless communication interface;

wherein said wireless interface module establishes one or more wireless links with one or more EIR terminals of said plurality of peer EIR terminals, to join said wireless network;
wherein said wireless interface module employs a power management scheme for controlling power management states of said wireless interface module at least between a wireless interface module awake state and a wireless interface module sleeping state;
wherein said terminal module employs a power management scheme for controlling power management states of said terminal module at least between a terminal module awake state and a terminal module sleeping state; and
wherein said EIR terminal is capable of operating in a mode in which said terminal module is in said terminal module sleeping state and said wireless interface module is in said wireless interface module awake state in such manner that power is conserved by said EIR terminal without disrupting participation of said wireless interface module in said mesh network.

8. The EIR terminal of claim 7, wherein said wireless interface module performs at least one of: receiving beacons, transmitting beacons, said beacons containing at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

9. The EIR terminal of claim 7, wherein said wireless interface module, responsive to receiving one or more data packets from said terminal module, incorporates said one or more data packets into one or more MAC frames and forwards said one or more MAC frames to one of: a peer EIR terminal, a wireless access point, one or more of said portals.

10. The EIR terminal of claim 7, wherein said wireless interface module, responsive to receiving one or more MAC frames, said one or more MAC frames containing one or more data packet addressed to said terminal module, transmits said one or more data packets to said terminal module.

11. A portable encoded information reading (EIR) terminal for incorporation in a data collection system having a plurality of peer EIR terminals, said plurality of peer EIR terminal collectively forming a wireless network, said wireless network being an OSI layer 2 network, said wireless network comprising zero or more wireless access points, said wireless network further comprising zero or more portals, each portal routing MAC frames between said wireless network and at least one OSI layer 2 network, said EIR terminal comprising:

- a terminal module including a first battery, a central processing unit (CPU), a memory, and an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform one of: outputting raw message data containing an encoded message, outputting decoded message data corresponding to an encoded message;
- a wireless interface module communicatively coupled to said terminal module via a wired interface, said wireless interface module including a second battery, a microcontroller, a memory, and at least one wireless communication interface;

wherein said wireless interface module establishes one or more wireless links with one or more EIR terminals of said plurality of peer EIR terminals, to join said wireless network; and
wherein said first battery is used to power said wireless interface module responsive to said second battery depletion, thus providing for uninterrupted operation of said wireless interface module.

12. The EIR terminal of claim 11, wherein said wireless interface is electrically coupled to a switching means;
wherein in a normal operation, said switching means electrically couple said wireless interface module to said second battery; and
wherein said switching means conditionally, upon depletion of said second battery, electrically couple said wireless interface module to said first battery.

13. The EIR terminal of claim 11, wherein said wireless interface is electrically coupled to a switching means;
wherein in a normal operation, said switching means electrically couple said terminal module to said first battery; and
wherein said switching means conditionally, upon depletion of said first battery, electrically couple said terminal module to said second battery.

14. The EIR terminal of claim 11, wherein said wireless interface module performs at least one of: receiving beacons, transmitting beacons, said beacons con-

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taining at least an identifier of a path selection protocol, said path selection protocol being used for unicast, multicast and broadcast frame transmission within said wireless network.

15. The EIR terminal of claim 1, 7, or 11, wherein said wireless interface module performs IEEE 802.11-conformant wireless station services including authentication, de-authentication, privacy, and MAC service data unit delivery; and
wherein said wireless interface module further performs IEEE 802.11-conformant wireless distribution system services including association, disassociation, distribution, integration, and re-association.

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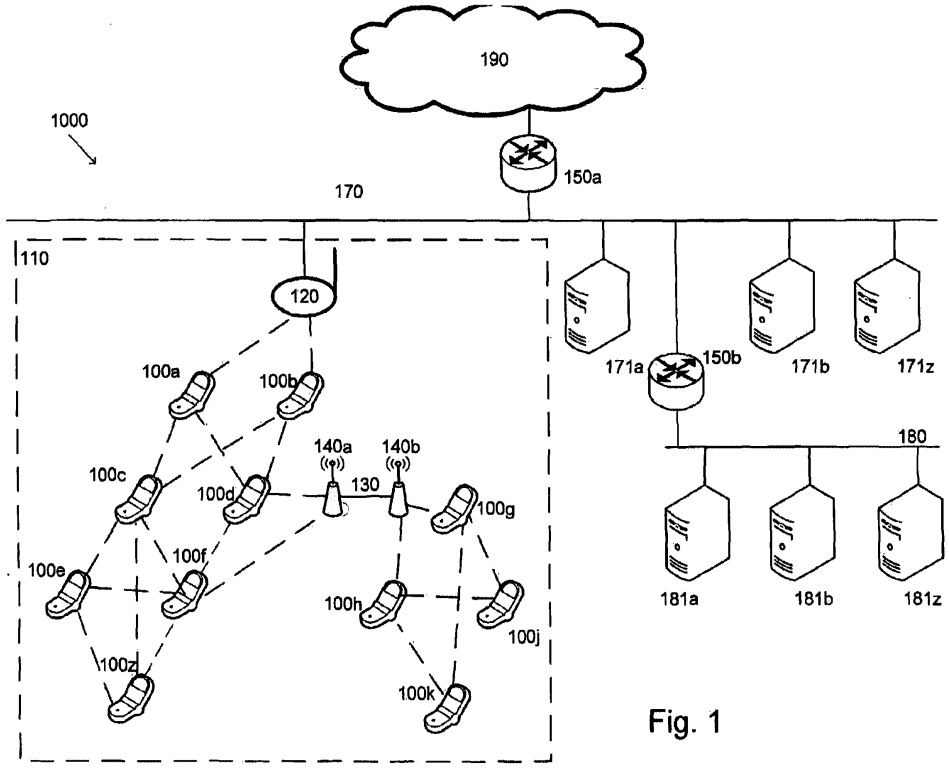

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Fig. 1

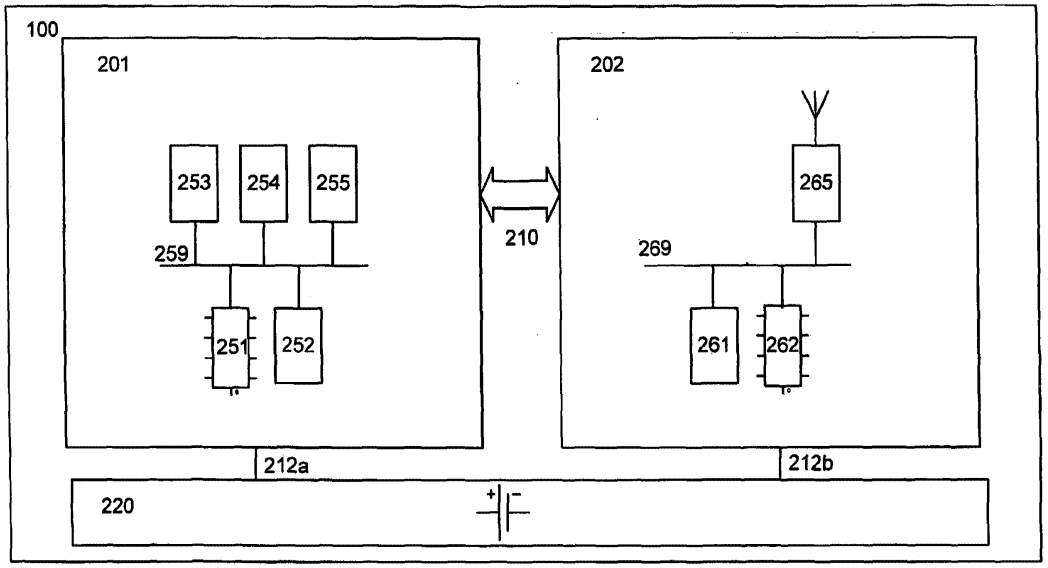

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Fig. 2a

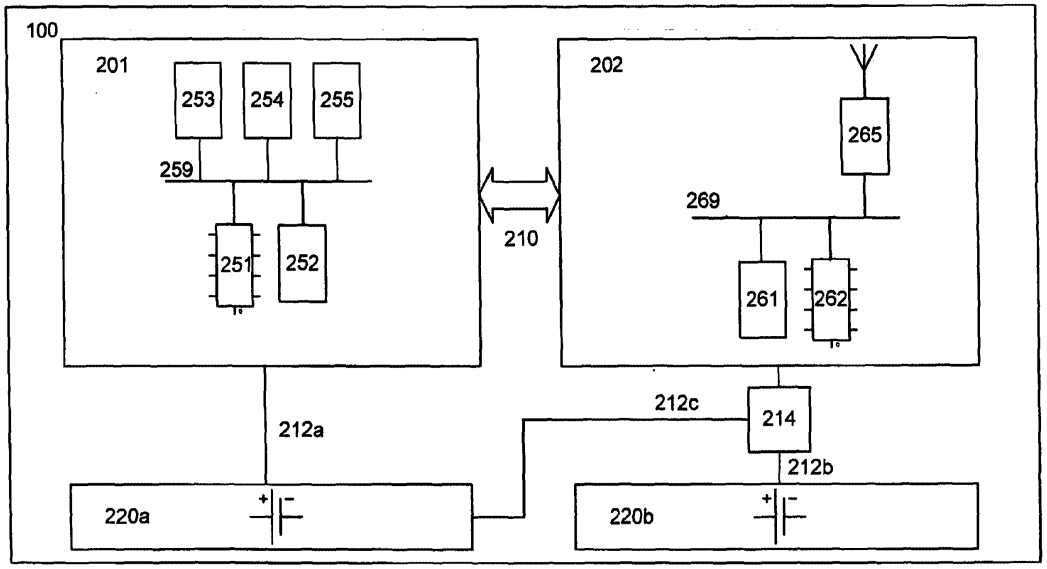

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Fig. 2b

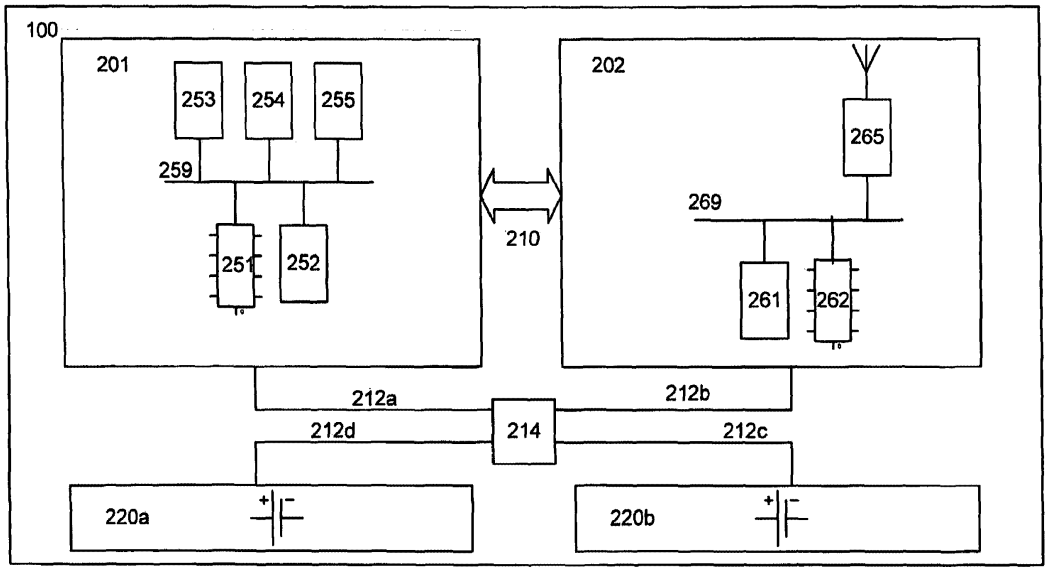

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Fig. 2c

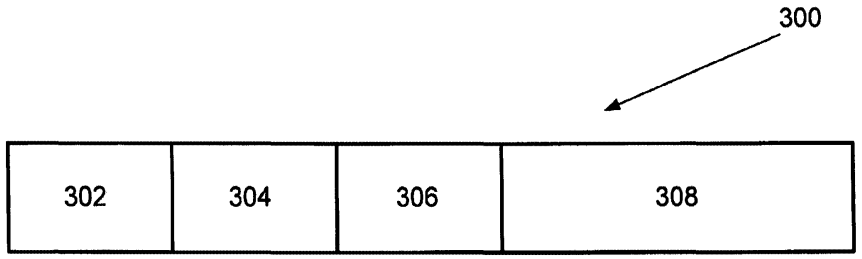


Fig. 3

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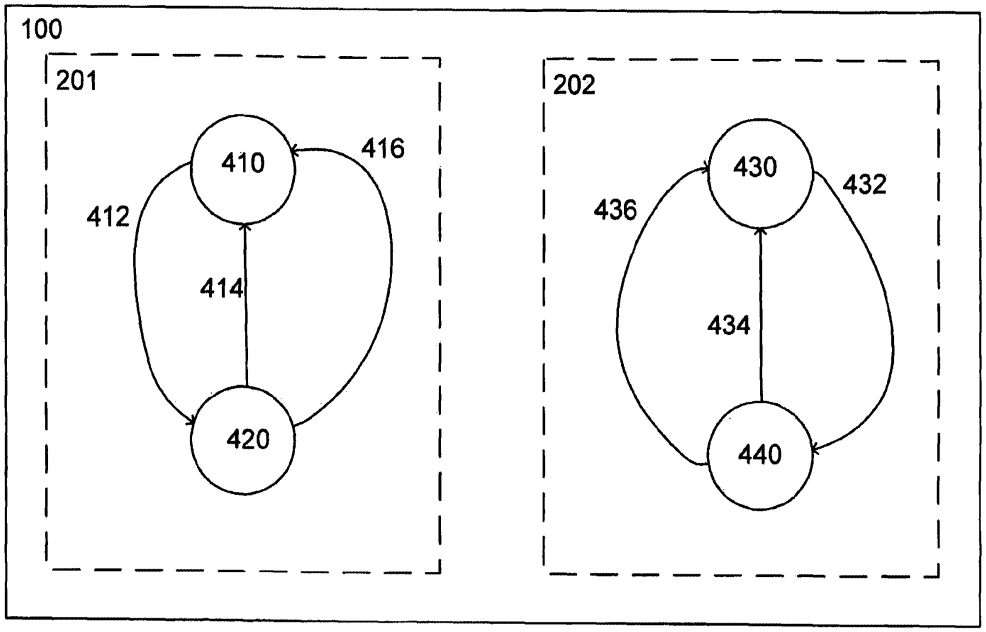


Fig. 4

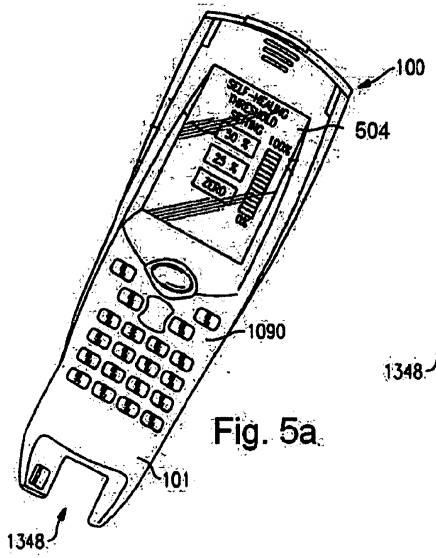

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Fig. 5a

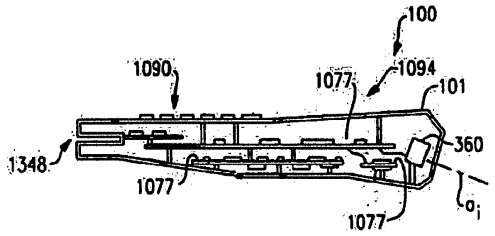

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Fig. 5b

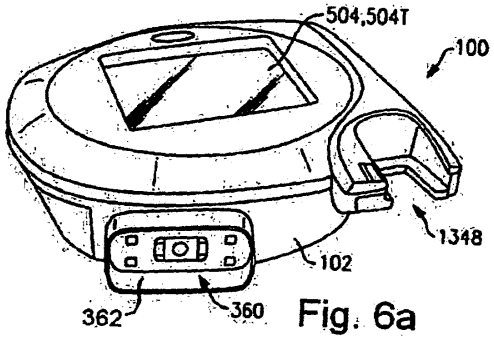


Fig. 6a

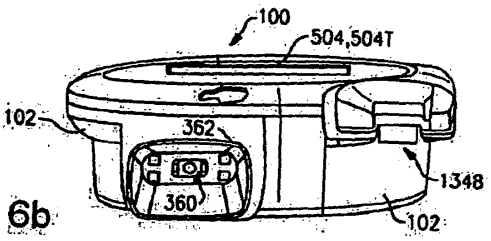


Fig. 6b

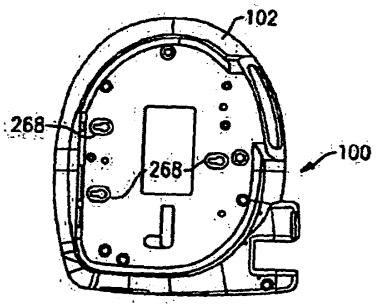


Fig. 6c

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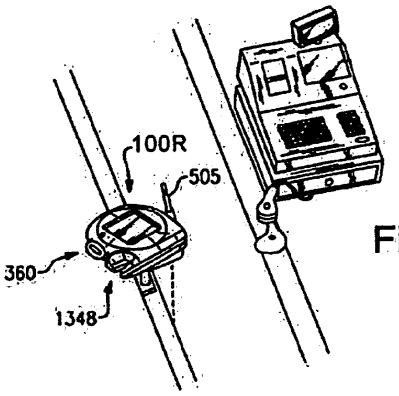


Fig. 7a

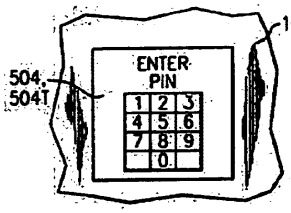


Fig. 7c

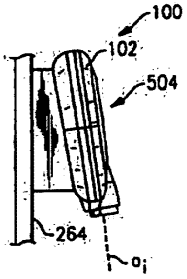


Fig. 7b

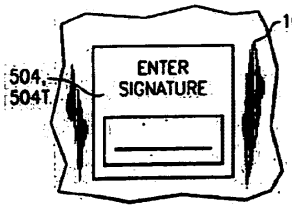


Fig. 7d

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REFERENCES CITED IN THE DESCRIPTION

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- US 60692890 B **[0072]**
- US 60694371 B **[0072]**

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Electronic Patent Application Fee Transmittal	
Application Number:	12567158
Filing Date:	25-Sep-2009
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Filer:	George S. Blasiak/Nicole Pruett
Attorney Docket Number:	H0022017
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	1801	1	930	930
		Total in USD ($)		**930**

Electronic Acknowledgement Receipt	
EFS ID:	11177128
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	George S. Blasiak/Nicole Pruett
Filer Authorized By:	George S. Blasiak
Attorney Docket Number:	H0022017
Receipt Date:	13-OCT-2011
Filing Date:	25-SEP-2009
Time Stamp:	10:42:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$930
RAM confirmation Number	8212
Deposit Account	081935
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

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16	Non Patent Literature	NPL_CI.pdf	104575 040d35674f83c278cd642831ccdf66ab97ac 9333	no	23
Warnings:					
Information:					
17	Non Patent Literature	NPL_CJ.pdf	1282807 9ab2d598e0635a067b67dc9285f3cd6ae5d 6bf3e	no	41
Warnings:					
Information:					

18	Non Patent Literature	NPL_CK.pdf	1152658 b21233f8f5ed303cb443484b4ddcbcba388b3980	no	35
Warnings:					
Information:					
19	Non Patent Literature	NPL_CL.pdf	896015 ce26e2878167f45a9512247e37b837ceafb2bf17	no	27
Warnings:					
Information:					
20	Non Patent Literature	NPL_CM.pdf	13786328 1d9efe900d7c51b7949b220a2ac7e513706ffcb7	no	94
Warnings:					
Information:					
21	Non Patent Literature	NPL_CN.pdf	487305 ca9bbd8f92613e1327ad1967da7db6f4e21d5ca0	no	5
Warnings:					
Information:					
22	Non Patent Literature	NPL_CO.pdf	409309 2b555fcd1a7dae25e9e2e3baf4e9f173b07ec8cc	no	10
Warnings:					
Information:					
23	Fee Worksheet (SB06)	fee-info.pdf	30768 f4b5a985a75c7b13288677ff4b4a61f8cda411a7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	33421680		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/567,158	Filing Date 09/25/2009	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	10/13/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 23	Minus	** 26	= 0	X $ =		OR	X $60=	0
	Independent (37 CFR 1.16(h))	* 4	Minus	***5	= 0	X $ =		OR	X $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/RAMONA WILSON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	10/18/2011	8038065	H0022017	3751

93689 7590 09/28/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 12 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Ynjiun P. Wang, Cupertino, CA;
Huyu Qu, San Jose, CA;
James T. Sauerwein, Charlotte, NC;

IR103 (Rev. 10/09)

Amendment After Allowance Under 37 C.F.R. 1.312
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 8, 2011
Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: Karl D. Frech

AMENDMENT AFTER ALLOWANCE UNDER 37 C.F.R. 1.312

MS Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPROVED: /K.F./

Sir:

OK TO ENTER: /K.F./

INTRODUCTORY COMMENTS

09/14/2011

Prior to issuance of the patent, applicant respectfully requests entry on this amendment under 37 C.F.R. 1.312 for the above-captioned patent application.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 9 of this paper.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

93689 7590 09/21/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER	
FRECH, KARL D	

ART UNIT	PAPER NUMBER
2887	

NOTIFICATION DATE	DELIVERY MODE
09/21/2011	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentservices-us@honeywell.com
mark.meagher@honeywell.com
DOCK@hrfmlaw.com

PTOL-90A (Rev. 04/07)

Response to Rule 312 Communication	Application No.	Applicant(s)
	12/567,158	WANG ET AL.
	Examiner	Art Unit
	KARL D. FRECH	2887

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☒ The amendment filed on *9/8/11* under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

TransCore LP
Exhibit 1023 (Page 246)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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93689 7590 06/08/2011

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Certificate of Mailing or Transmission

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via Office electronic filing system in accordance with §1.6(a)(4).

Nicole R. Pruett	(Depositor's name)
/Nicole R. Pruett/	(Signature)
September 8, 2011	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Yajun P. Wang	H0022017	3751

TITLE OF INVENTION: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	09/08/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRECH, KARL D	2887	235-462250

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363)

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 Hiscin Rothenberg Farley & Mesiti P.C.

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Hand Held Products, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Skaneateles Falls, New York 13153

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee

☒ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 08-1935 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /George S. Blasiak/ Date September 8, 2011

Typed or printed name George S. Blasiak Registration No. 37,283

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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TransCore LP
Exhibit 1023 (Page 247)

Electronic Patent Application Fee Transmittal	
Application Number:	12567158
Filing Date:	25-Sep-2009
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Filer:	George S. Blasiak
Attorney Docket Number:	H0022017
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1510	1510
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1810**

Electronic Acknowledgement Receipt

EFS ID:	10901947
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	George S. Blasiak
Filer Authorized By:	
Attorney Docket Number:	H0022017
Receipt Date:	08-SEP-2011
Filing Date:	25-SEP-2009
Time Stamp:	12:34:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1810
RAM confirmation Number	12555
Deposit Account	081935
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Applicant Arguments/Remarks Made in an Amendment	4283687_H0022017_Amendment.pdf	251562 cd2f756c254e47f859023dbbe55b5b147652519b	no	9
Warnings:					
Information:					
2	Issue Fee Payment (PTO-85B)	4283687_H0022017_IssueTransmittal.pdf	179761 a5642997737305 9e17bfdaf2a5fe32b20705c716	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32230 bc073d08fc1094c7fb6bb43a0606b5ae4a298f1d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	463553		

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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Amendment After Allowance Under 37 C.F.R. 1.312
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Dated: September 8, 2011
Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: Karl D. Frech

AMENDMENT AFTER ALLOWANCE UNDER 37 C.F.R. 1.312

MS Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

Prior to issuance of the patent, applicant respectfully requests entry on this amendment under 37 C.F.R. 1.312 for the above-captioned patent application.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 9 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Original) An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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Exhibit 1023 (Page 253)

2. (Original) The EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

3. (Currently Amended) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

4. (Currently Amended) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

5. (Currently Amended) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

TransCore LP
Exhibit 1023 (Page 254)

6. (Currently Amended) The EIR terminal of claim 1, further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

7. (Currently Amended) The EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

8. (Currently Amended) The EIR terminal of claim 1, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

9. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter

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Exhibit 1023 (Page 255)

(ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

10. (Original) The EIR terminal of claim 9, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

11. (Original) The EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

12. (Original) The EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

13. (Currently Amended) The EIR terminal of claim 9, further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

14. (Currently Amended) The EIR terminal of claim 9, further configured to dynamically select at least one of a wireless communication network, a wireless communication

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protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

15. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

16. (Original) The EIR terminal of claim 15, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

17. (Original) The EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

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18. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

19. (Original) The EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

20. (Original) The EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets.

21. (Original) The EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

22. (Original) The EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

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23. (Original) The EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

24. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

25. (Original) The EIR terminal of claim 24, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

26. (Original) The EIR terminal of claim 24, wherein said wireless communication interface is implemented using two or more chipsets.

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REMARKS

Various claim amendments are presented herein to address informalities. In that the claim amendments presented herein do not further limit any claim, the amendments presented herein will not be regarded as "narrowing" claim amendments. The present amendment was not presented earlier for the reason that the review yielding the determination that the amendments would be desirable was not concluded until after close of prosecution.

It is believed that the claims of the present application file have been addressed. However, failure to address a specific rejection, issue, or comment in the present file history does not signify agreement with or concession of that rejection, issue, or comment. In addition, because the arguments made in the present file history are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in the present file history should be construed as an intent to concede any issue with regard to any claim, except as specifically stated, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

No amendment presented herein contains new matter.

Applicants believe no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 08-1935.

Dated: September 8, 2011

Respectfully submitted,
Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283
HESLIN ROTHENBERG
FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
(518) 452-5600
Customer No.: 93689

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Exhibit 1023 (Page 260)

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

93689 7590 08/25/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER	
FRECH, KARL D	

ART UNIT	PAPER NUMBER
2887	

NOTIFICATION DATE	DELIVERY MODE
08/25/2011	ELECTRONIC

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mark.meagher@honeywell.com
DOCK@hrfmlaw.com

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Exhibit 1023 (Page 261)

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
12/567,158	25 September 2009	WANG ET AL.	H0022017

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER	
KARL D. FRECH	
ART UNIT	**PAPER**
2887	20110822

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Commissioner for Patents

Attached is applicant's considered copy of the IDS filed after allowance on 8/17/11.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

PTO-90C (Rev.04-03)

PTO/SB/08a (07-09)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	/Karl Frech/	Date Considered	08/22/2011

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Sheet 2 of 2

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Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

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Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	CA	EUROPEAN PATENT OFFICE, European Search Report, European Patent Application Number: 10176444.7, dated June 6, 2011 (5 pages).	EN

Examiner Signature	/Karl Frech/	Date Considered	/Karl Frech/

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Sheet 1 of 2

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Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

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Sheet 2 of 2

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Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

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	CA	EUROPEAN PATENT OFFICE, European Search Report, European Patent Application Number: 10176444.7, dated June 6, 2011 (5 pages).	EN

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Electronic Patent Application Fee Transmittal	
Application Number:	12567158
Filing Date:	25-Sep-2009
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Filer:	George S. Blasiak/Nicole Pruett
Attorney Docket Number:	H0022017
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	10753576
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	George S. Blasiak/Nicole Pruett
Filer Authorized By:	George S. Blasiak
Attorney Docket Number:	H0022017
Receipt Date:	17-AUG-2011
Filing Date:	25-SEP-2009
Time Stamp:	11:24:01
Application Type:	Utility under 35 USC 111(a)

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Payment was successfully received in RAM	$180
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Deposit Account	081935
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Transmittal Letter	4283687_H0022017_IDS.pdf	225094 766c40a79797fc20f80f9750e69d97f47023b95f	no	3
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	4283687_H0022017_SB08.pdf	436265 e80c79f2ceb96bb2311892854429086 56d6ffef6	no	2
Warnings:					
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4	Fee Worksheet (SB06)	fee-info.pdf	30607 9d423c540f8003eaa7087dfa733755473846 5316	no	2
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Dated: August 17, 2011
Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: K. D. Frech

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT (IDS)

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 CFR 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the “References Cited” on any patent to issue therefrom.

In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. In accordance with 37 CFR 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that any patent, publication or other information referred to therein is “prior art” for this invention unless specifically designated as such.

It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

I hereby certify, pursuant to 37 CFR 1.97(e)(1), that each item of information contained in this Information Disclosure Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement. Where a document referenced in a communication from a foreign patent office was previously made of record, the document is resubmitted herein for completion of information of the communication.

In column T^6 and T^2 of the attached PTO 1449 form, "EN" is entered where the cited reference is in the English language, "AO" is entered where the reference is not in English but a translation of the Abstract only is included, and "FT" is entered where the reference is not in English but a full text English translation is included.

Applicants believe no fee is required with this submission. The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 08-1935.

Dated: August 17, 2011

Respectfully submitted,
Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283
HESLIN ROTHENBERG
FARLEY & MESITI P.C.
5 Columbia Circle
Albany, New York 12203
(518) 452-5600
Customer No.: 93689

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

93689 7590 08/12/2011

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Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER	
FRECH, KARL D	

ART UNIT	PAPER NUMBER
2887	

NOTIFICATION DATE	DELIVERY MODE
08/12/2011	ELECTRONIC

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mark.meagher@honeywell.com
DOCK@hrfmlaw.com

TransCore LP
Exhibit 1023 (Page 274)

Supplemental Notice of Allowability	**Application No.** 12/567,158	**Applicant(s)** WANG ET AL.	
	Examiner KARL D. FRECH	**Art Unit** 2887	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *3/30/11*.

2. ☒ The allowed claim(s) is/are *1-26*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

TransCore LP
Exhibit 1023 (Page 275)

1. In order to comply with MPEP 608.01 (b), an EXAMINER'S AMENDMENT to the ABSTRACT, has been entered as seen on the attached page:

2. Claims 1-26 remain allowed for the same reasons as set forth in the previous Notice of Allowance.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARL D. FRECH whose **EMAIL address is** karl.frech@uspto.gov. If attempts to reach the examiner by **EMAIL** are unsuccessful, the examiner's telephone number is (571)272-2390. The examiner can normally be reached on maxi-flex.

IFF ALL attempts to reach the examiner by **EMAIL** and telephone are unsuccessful, the examiner's supervisor, Steven Paik can be reached on (571) 272-2404. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

***

ABSTRACT

- - An encode information reading terminal can have a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, and a wireless communication interface. The EIR can be selected from the group including a bar code reader, an RFID reader, and a card reader. The EIR can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message. The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter which can be electrically coupled to the system bus and/or to a digital-to-analog converter which can be electrically coupled to the system bus. - -

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/567,158	WANG ET AL.	
	Examiner	Art Unit	
	KARL D. FRECH	2887	

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
235	462.25	235	462.44	472.01					
INTERNATIONAL CLASSIFICATION									
G 0 6 K	19/06								
	/								
	/								
	/								
	/								

(Assistant Examiner) (Date)	/Karl D Frech/ 8/9/11 (Primary Examiner) (Date)	Total Claims Allowed: 26	
(Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1	O.G. Print Fig.: 6a

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		31		61		91		121		151		181
2	2		32		62		92		122		152		182
3	3		33		63		93		123		153		183
4	4		34		64		94		124		154		184
5	5		35		65		95		125		155		185
6	6		36		66		96		126		156		186
7	7		37		67		97		127		157		187
8	8		38		68		98		128		158		188
9	9		39		69		99		129		159		189
10	10		40		70		100		130		160		190
11	11		41		71		101		131		161		191
12	12		42		72		102		132		162		192
13	13		43		73		103		133		163		193
14	14		44		74		104		134		164		194
15	15		45		75		105		135		165		195
16	16		46		76		106		136		166		196
17	17		47		77		107		137		167		197
18	18		48		78		108		138		168		198
19	19		49		79		109		139		169		199
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21	21		51		81		111		141		171		201
22	22		52		82		112		142		172		202
23	23		53		83		113		143		173		203
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25	25		55		85		115		145		175		205
26	26		56		86		116		146		176		206
	27		57		87		117		147		177		207
	28		58		88		118		148		178		208
	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

TransCore LP
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Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination
	12/567,158	WANG ET AL.
	Examiner	Art Unit
	KARL D. FRECH	2887

SEARCHED			
Class	Subclass	Date	Examiner
235	462.25 462.44 462.45 462.46	8/9/2011	KDF
235	472.01	8/9/2011	KDF
235	472.02	8/9/2011	KDF
235	472.03	8/9/2011	KDF

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
same as	**above**	8/9/2011	**KDF**

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
updated	8/9/2011	KDF

U.S. Patent and Trademark Office

Part of Paper No. 20110810

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
12/567,158	WANG ET AL.
Examiner	**Art Unit**
KARL D. FRECH	2887

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	8/9/11
1	1	=
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Claim		Date
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Claim		Date
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

93689 7590 06/08/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER
FRECH, KARL D

ART UNIT	PAPER NUMBER
2887	

DATE MAILED: 06/08/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

TITLE OF INVENTION: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	09/08/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

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Exhibit 1023 (Page 281)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

93689 7590 06/08/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

TITLE OF INVENTION: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	09/08/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRECH, KARL D	2887	235-462250

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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Exhibit 1023 (Page 282)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

93689 7590 06/08/2011

HONEYWELL/HRFM
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER	
FRECH, KARL D	

ART UNIT	PAPER NUMBER
2887	

DATE MAILED: 06/08/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 35 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 35 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

TransCore LP
Exhibit 1023 (Page 283)

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No.	Applicant(s)	
	12/567,158	WANG ET AL.	
	Examiner	Art Unit	
	KARL D. FRECH	2887	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *3/30/11*.

2. ☒ The allowed claim(s) is/are *1-26*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 3/11
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

TransCore LP
Exhibit 1023 (Page 285)

1. Claims 1-26 are allowed.

2. The following is an examiner's statement of reasons for allowance: applicant's arguments filed 3/30/11 are deemed persuasive.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARL D. FRECH whose **email address is** karl.frech@ustpo.gov. If attempts to reach the examiner by **email** are unsuccessful, the examiner's telephone number is (571)272-2390. The examiner can normally be reached on maxi-flex.

IFF ALL attempts to reach the examiner by **email** and telephone are unsuccessful, the examiner's supervisor, Steven Paik can be reached on (571) 272-2404. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

***
3.

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
12/567,158	WANG ET AL.
Examiner	**Art Unit**
KARL D. FRECH	2887

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	6/1/11
1	1	=
2	2	=
3	3	=
4	4	=
5	5	=
6	6	=
7	7	=
8	8	=
9	9	=
10	10	=
11	11	=
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Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	12/567,158	WANG ET AL.	
	Examiner	Art Unit	
	KARL D. FRECH	2887	

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
235	462.25	235	462.44	472.01					
INTERNATIONAL CLASSIFICATION									
G 0 6 K	19/06								
	/								
	/								
	/								
	/								

---------- (Assistant Examiner) (Date)	/Karl D Frech/ 6/1/11 (Primary Examiner) (Date)	Total Claims Allowed: 26
(Legal Instruments Examiner) (Date)		O.G. Print Claim(s): 1 / O.G. Print Fig.: 6a

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		31		61		91		121		151		181
2	2		32		62		92		122		152		182
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Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination
	12/567,158	WANG ET AL.
	Examiner	Art Unit
	KARL D. FRECH	2887

SEARCHED			
Class	Subclass	Date	Examiner
235	462.25 462.44 462.45 462.46	6/1/2011	KDF
235	472.01	6/1/2011	KDF
235	472.02	6/1/2011	KDF
235	472.03	6/1/2011	KDF

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
same as	**above**	6/1/2011	**KDF**

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
updated	6/1/2011	KDF

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Part of Paper No. 20110602

PTO/SB/08a (07-09)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

Complete if Known	
Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-20090148074	06-11-2009	XU et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	BA	WO-9814023-A1	04-02-1998	Advanced Micro Devices Inc		EN

Examiner Signature	/Karl Frech/	Date Considered	06/02/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

IDS (Citation) by Applicant (3 References)

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Dated: March 18, 2011 Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KF/

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	CA	EUROPEAN PATENT OFFICE, Partial European Search Report, European Patent Application Number: 10176444.7, dated February 11, 2011 (8 pages).	EN

Examiner Signature	/Karl Frech/	Date Considered	06/02/2011

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1]Applicant's unique citation designation number (optional). [2]Applicant is to place a check mark here if English language Translation is attached.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017

CONFIRMATION NO. 3751

PUBLICATION NOTICE

93689
HONEYWELL/MARJAMA
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

OC000000046868415

Title:ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Publication No.US-2011-0073654-A1
Publication Date:03/31/2011

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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Amendment in Response to Non-Final Office Action Under 37 C.F.R. 1.111
I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: March 30, 2011
Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: K. D. Frech

AMENDMENT IN RESPONSE TO NON-FINAL OFFICE ACTION UNDER 37 C.F.R. 1.111

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

INTRODUCTORY COMMENTS

In response to the Office action dated December 30, 2010, please amend the above-identified U.S. patent application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 9 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Original) An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

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2. (Original) The EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

3. (Original) The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

4. (Original) The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

5. (Original) The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

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6. (Original) The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

7. (Original) The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

8. (Original) The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

9. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter

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(ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

10. (Original) The EIR terminal of claim 9, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

11. (Original) The EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

12. (Original) The EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

13. (Original) The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

14. (Original) The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a

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parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

15. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

16. (Original) The EIR terminal of claim 15, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

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17. (Original) The EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

18. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

19. (Original) The EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

20. (Original) The EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets.

21. (Original) The EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

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22. (Original) The EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

23. (Original) The EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

24. (Original) An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

25. (Original) The EIR terminal of claim 24, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

26. (Original) The EIR terminal of claim 24, wherein said wireless communication interface is implemented using two or more chipsets.

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REMARKS

This document is a response to the Office Action mailed on December 30, 2010.

Claims 1-26 stand rejected under *35 U.S.C. § 103(a)* as being obvious in view of U.S. Patent Publication No. 2007/0122058 to Yeakley *et al.* ('Yeakley').

The Examiner bears the burden of establishing a *prima facie* case of obviousness based on prior art when rejecting claims under *35 U.S.C. § 103*.[1] The prior art reference (or references when combined) must teach or suggest all the claim limitations.[2] "In determining obviousness, the scope and content of the prior art are… determined; differences between the prior art and the claims at issue are… ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or non-obviousness of the subject matter is determined."[3] "Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue."[4] "Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness."[5]

With respect to the obviousness rejection of claims 1-26, the applicants respectfully assert that the Examiner improperly grouped claims 1-26 in a common rejection[6], contrary to the MPEP provision stating that "[a] plurality of claims should never be grouped together in a common rejection, unless that rejection is equally applicable to all claims in the

---

[1] *In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992).
[2] *In re Royka,* 490 F.2d 981, 180 USPQ 580 (CCPA 1974).
[3] *Graham v. John Deere Co.*, 383 U.S. 1 (1966).
[4] *KSR Int'l. Co. v. Teleflex, Inc.*, No. 04-1350 (U.S. Apr. 30, 2007).
[5] *Id.* (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).
[6] Office Action of December 30, 2010, page 2.

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group."[7] The applicants respectfully assert that claims 1-26 recite diverse subject matter and accordingly grouping of claims 1-26 into a common rejection is not permitted under *MPEP §707(d)*. Since no claim numbers are given in the omnibus rejection, it is not clear what the pertinence of the relied upon references and official notices are. The applicants respectfully submit that the omnibus rejection presented by the Examiner does not address all the claim limitations of every claim, and hence the rejection is incomplete, vague, and impossible to reply to with any specificity. Therefore, the applicants are unable to positively correlate the various sentences of the rejection with specific claims.

If the Examiner wishes to maintain the rejections of claims 1-26, the Examiner is respectfully requested to state the rejections in a form other than an omnibus form, and to address all limitations of every rejected claim, or explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art as required by *MPEP §2141(III)*.

Further with respect with the obviousness rejection of claims 1-26, the Examiner, rather than making reference to specific teachings of a prior art reference, took an Official Notice stating that "A/D conversion is typical and old and well-known in bar code readers. It would have been obvious to a person of ordinary skill in the art to convert the analog signal from the read bar code to a digital signal (for the Bluetooth communications) to provide a more accurate and efficient transmission."[8]

The applicants respectfully assert that an official notice without documentary evidence to support an Examiner's conclusion is permissible only in some circumstances.[9] Official notice unsupported by documentary evidence should only be taken by the Examiner where the facts asserted to be well-known, or to be common knowledge in the art are capable of instant and unquestionable demonstration as being well-known. As

[7] *MPEP §707.07(d).*
[8] Office Action of December 30, 2010, page 3.
[9] MPEP §2144.03(A)

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noted by the court in *In re Ahlert*[10], the notice of facts beyond the record which may be taken by the Examiner must be "capable of such instant and unquestionable demonstration as to defy dispute."[11] It would not be appropriate for the Examiner to take official notice of facts without citing a prior art reference where the facts asserted to be well known are not capable of instant and unquestionable demonstration as being well-known. For example, assertions of technical facts in the areas of esoteric technology or specific knowledge of the prior art must always be supported by citation to some reference work recognized as standard in the pertinent art.[12]

If the Examiner wishes to maintain the rejections of claims rejected based on Official Notice, the Examiner is respectfully requested to provide documentary evidence in support of the various assertions of common knowledge.[13] In providing such evidence, the Examiner is respectfully requested to make reference to the specific combinations of claim limitations of every claim rejected with reliance of the Official Notice. The Examiner is also respectfully requested to set forth explicitly the reasons for the various rejections based on Office Notice.[14] The Examiner must provide specific factual findings predicated on sound technical and scientific reasoning to support his or her conclusion of common knowledge.[15]

The applicants further respectfully assert that even if the Official Notice relied upon by the Examiner in rejecting claims 1-26 was permissible (which the applicants respectfully contend that it is not, for the reasons set forth herein *supra*), the Official Notice at least fails to address the limitation of independent claim 1 and several other claim reciting an analog to digital converter. In fact, the Examiner's Official Notice states that "it would have been obvious to a person of ordinary skill in the art to convert the analog signal **from the read bar code to a digital signal (for the Bluetooth communications)** to provide a more

[10] 424 F.2d 1088, 1091, 165 USPQ 418, 420 (CCPA 1970)
[11] Citing In re Knapp Monarch Co., 296 F.2d 230, 132 USPQ 6 (CCPA 1961).
[12] *In re Ahlert*, 424 F.2d at 1091, 165 USPQ at 420-21 cited by MPEP §2144.03(A).
[13] MPEP §2144.03(A).
[14] See MPEP §2144.03(B).
[15] MPEP §2144.03(B).

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accurate and efficient transmission" (emphasis added), while independent claim 1 and several other claim recite "ADC [being] configured **to output a second encoded bit stream corresponding to an analog signal produced by [a] radio frequency front end**" (emphasis added), in the context of other elements the claims recite. Thus, the Examiner's Official Notice did not even attempt to address converting an encoded bit stream corresponding to an analog signal converted by a radio frequency front end, as recited by independent claim 1 and several other claims.

Further with respect to the obviousness rejection of claims 1-26, the applicants respectfully submit that the Examiner did not even attempt to address every limitation of every rejected claim or explain why the difference(s) between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art as required by *MPEP §2141(III)*.

Thus, the applicants respectfully submit that the Examiner has not established that the prior art of record teaches all of the limitations of claims 1-26, and thus failed to ascertain differences between the prior art and the claims at issue, as is required under *KSR*.

If the Examiner wishes to maintain an obviousness rejection of claims over Yeakley, the Examiner is respectfully requested to explain where in the relied upon references there are teachings related to all the limitations of every rejected claim, and to present a convincing evidence that combining the relied upon references was a design step well within the grasp of a person of ordinary skill in the relevant art.[16]

With respect to the claim rejections argued by the applicants herein *supra*, while the applicants herein may have highlighted a particular claim element of a claim for purposes of demonstrating insufficiency of the examination on the part of the Examiner, the applicants' highlighting of a particular claim element for such purpose should not be taken

[16] KSR Int'l Co v. Teleflex Inc., 127 S. Ct. 1727 (2007).

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to indicate that the applicants have asserted an argument in support of patentability that a particular claim element constitutes the sole basis for patentability out of the context of the various combinations of elements of the claim or claims in which it is present. The applicants maintain the right here forward to assert that each claim is patentable by reason of any patentable combination recited therein.

No amendment presented herein contains new matter.

Regarding the claims discussed herein, the applicants' selective treatment and emphasis of independent claims of the application should not be taken as an indication that the applicants believe that the Examiner's dependent claim rejections are otherwise sufficient. Applicants expressly reserve the right to present arguments traversing the propriety of the dependent claim rejections later in the prosecution of this or another application.

Regarding the dependent claims herein, the dependent claims are respectfully asserted to be allowable for their dependence on an allowable base claim and for the additional elements recited therein.

It is believed that all of the pending claims have been addressed. However, failure to address a specific rejection, issue, or comment in the present file history does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made in the present file history are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in the present file history should be construed as an intent to concede any issue with regard to any claim, except as specifically stated, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

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Accordingly, in view of the above amendments and remarks, applicants believe all of the claims of the present application to be in condition for allowance and respectfully request reconsideration and passage to allowance of the application.

If the Examiner believes that contact with the applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call the applicants' representative at the phone number listed below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to deposit Account No. 50-0289.

Dated: March 30, 2011

Respectfully submitted,

Electronic signature: /Dmitry Andreev/
Dmitry Andreev
Registration No.: 57,428
Marjama Muldoon Blasiak & Sullivan LLP
250 South Clinton Street
Suite 300
Syracuse, New York 13202
(315) 425-9000
Customer No.: 93689

DA/np/bs

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(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission	15

Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

ENCLOSURES (*Check all that apply*)

- [ ] Fee Transmittal Form
- [ ] Fee Attached
- [x] Amendment/Reply
- [ ] After Final
- [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
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- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
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- [ ] Proprietary Information
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- [ ] Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	MARJAMA MULDOON BLASIAK & SULLIVAN LLP		
Signature	/Dmitry Andreev/		
Printed name	Dmitry Andreev		
Date	March 30, 2011	Reg. No.	57,428

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EFS ID:	9774181
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	George S. Blasiak/Barbara Saltsman
Filer Authorized By:	George S. Blasiak
Attorney Docket Number:	H0022017
Receipt Date:	30-MAR-2011
Filing Date:	25-SEP-2009
Time Stamp:	15:54:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Amendment/Req. Reconsideration-After Non-Final Reject	283_687_-_Amendment_-_03_17_11_02.pdf	69674 03cee898b53a7e97867a7b24019073b7aaa46cd9	no	14

Warnings:	
Information:	

2	Miscellaneous Incoming Letter	283_687_-_Transmittal_PTO_SB-21_-_03_17_11_02.pdf	28954 68625542110274 1a80e7566a6e5defbf7e39bd20	no	1
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			Total Files Size (in bytes):	98628	

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New International Application Filed with the USPTO as a Receiving Office
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Application or Docket Number	Filing Date	☐ To be Mailed
12/567,158	09/25/2009	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 03/30/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 26	Minus	** 26	= 0	X $ =		OR	X $52=	0
Independent (37 CFR 1.16(h))	* 5	Minus	***5	= 0	X $ =		OR	X $220=	0
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

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** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

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The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/STEFANIE BRYCE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 2

Complete if Known	
Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-20090148074	06-11-2009	XU et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]
	BA	WO-9814023-A1	04-02-1998	Advanced Micro Devices Inc		EN

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

IDS (Citation) by Applicant (3 References)

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Dated: March 18, 2011 Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 2

Complete if Known	
Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]
	CA	EUROPEAN PATENT OFFICE, Partial European Search Report, European Patent Application Number: 10176444.7, dated February 11, 2011 (8 pages).	EN

Examiner Signature		Date Considered	

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Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: 12/567,158 Confirmation No.: 3751

Filed: September 25, 2009 Art Unit: 2887

For: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Examiner: K. D. Frech

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT (IDS)

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to 37 CFR 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of this application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

In accordance with 37 CFR 1.97(g), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 CFR 1.56(a) exists. In accordance with 37 CFR 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that any patent, publication or other information referred to therein is "prior art" for this invention unless specifically designated as such.

It is submitted that the Information Disclosure Statement is in compliance with 37 CFR 1.98 and the Examiner is respectfully requested to consider the listed references.

I hereby certify, pursuant to 37 CFR 1.97(e)(1), that each item of information contained in this Information Disclosure Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement. Where a document referenced in a communication from a foreign patent office was previously made of record, the document is resubmitted herein for completion of information of the communication.

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Applicants believe no fee is required with this submission. The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-0289.

Dated: March 18, 2011

Respectfully submitted,

Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283
MARJAMA MULDOON BLASIAK &
SULLIVAN LLP
250 South Clinton Street
Suite 300
Syracuse, New York 13202
(315) 425-9000
Customer No.: 93689

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(51) **International Patent Classification** 6 :
H04Q 7/32, H04B 1/40

A1

(11) **International Publication Number:** **WO 98/14023**

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(30) **Priority Data:**
08/719,799 25 September 1996 (25.09.96) US

(71) **Applicant:** ADVANCED MICRO DEVICES, INC. [US/US]; 5204 East Ben White Boulevard, Mail Stop 562, Austin, TX 78741 (US).

(72) **Inventors:** ASGHAR, Saf, M.; 7010 Quill Leaf Cove, Austin, TX 78750 (US). SPAK, Michael, E.; Box 170, Route 1, Kyle, TX 78640 (US).

(74) **Agent:** RILEY, Louis, A.; Advanced Micro Devices, Inc., 5204 East Ben White Boulevard, M/S 562, Austin, TX 78741 (US).

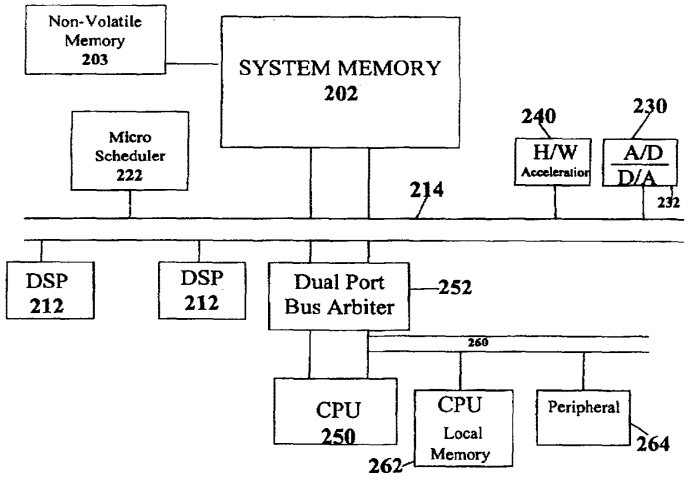
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Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) **Title:** CONFIGURABLE DIGITAL WIRELESS AND WIRED COMMUNICATIONS SYSTEM ARCHITECTURE

(57) **Abstract**

A configurable multiprocessor communications architecture which performs digital communications functions and which is configurable for different digital communications standards, such as various digital cellular standards. In the preferred embodiment, the multiprocessor architecture includes two or more digital signal processing cores (212), a microcontroller or microscheduler (222), a voice coder/decoder (codec), and a relatively low performance central processing unit (CPU) (250). Each of the above devices are coupled to a system memory (202). The general purpose CPU preferably performs user interface functions and overall communications management functions. A CPU local memory (262) and various peripheral devices (264) are coupled through a CPU local bus (260) to the CPU, and these devices are accessible to the CPU without the CPU having to access the main system bus. A dual port bus arbiter (252) is preferably coupled between the CPU and the system bus (214) and controls access to the system bus and the CPU local bus. The microscheduler operates to schedule operations and/or functions, as well as dynamically control the clock rates, of each of the DSPs and the hardware acceleration logic (240) to achieve the desired throughput while minimizing power consumption. The present invention thus provides a single architecture which has simplified configurability for different digital standards. The configurable digital communications architecture simplifies design and manufacturing costs and provides improved performance over prior designs.



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BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

Title: Configurable Digital Wireless and Wired Communications System Architecture

Field of the Invention

The present invention relates to communications systems for wired and wireless environments, and more particularly to a communications architecture for wired and wireless communication environments which is configurable according to a plurality of possible different digital transmission standards.

Description of the Related Art

Wireless information networks are currently experiencing enormous growth throughout the world. Examples of wireless information networks include cordless telephones, personal communications services (PCS), cellular telephones, paging systems, mobile data networks, and mobile satellite systems. In conjunction with the growth in wireless information networks, communications networks are currently undergoing a transition from analog-based technology to digital technology. Wireless information networks will benefit greatly from digital implementations, including better performance, increased capacity, and a wider offering of services.

Various types of wireless information networks exist, including networks designed for voice and data. In general, different networks exist for voice and data because of the different and often contradictory requirements of voice service and data service. Thus, although digitized voice, video and data are all "binary digits" (bits), each service has different requirements in a digital network. For example, wireless voice data services are required to be comparable to a user's expectation of telephone voice quality in the public switched telephone network (PSTN). Thus, packetized voice service in a wireless network must minimize time delays in transmission. In general, in a voice transmission, inter-packet delays in excess of 100 msec are noticeable and annoying to the listener. In contrast, in a data services network, time delays are generally irrelevant to the user. Also, packetized voice service can tolerate packet loss rates on the order of 10^{-2},

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or bit error rates of the same order, without a noticeable degradation of service quality. In contrast, data services require a much lower error rate, and loss of data packets is generally unacceptable. Voice conversations also typically generate Megabytes of digitized information and last at least several minutes, whereas data transfers typically involve less data and are shorter in length.

Thus, wireless information networks typically involve either voice-driven applications such as digital cellular, PCS, cordless telephones, and wireless PBX, or data-driven networks such as wireless LANs and mobile data networks. For voice applications, digital cellular systems are designed to support mobile users roaming over wide geographic areas, whereas PCS, cordless telephones and wireless PBX systems are designed for relatively smaller geographic areas. For data applications, mobile data networks operate a relatively low data rates over urban radio channels, whereas wireless LANs are typically designed to support a limited number of users in a well-defined local area.

Cellular mobile telephone service is one of the most rapidly growing segments of the wireless communications industry. As mentioned above, digital cellular system is designed to support mobile users roaming over wide geographic areas, and thus coverage is provided by an arrangement of cells with a cell size typically 0.5 to 5 miles in diameter. There are currently several digital cellular standards initiatives in the United States, Europe, and Japan, including GSM (Groupe Special Mobile), IS-54, Japanese Digital Cellular (JDC), and Code Division Multiple Access (CDMA). Thus, current digital cellular telephone architectures are required to accommodate a plurality of different digital communication standards.

Current digital cellular telephone architectures generally include a different integrated circuit chip set, particularly in the baseband section, for accommodating each of these digital standards. Each of these different IC chipsets for performing different digital standards is generally only available from a few select companies, thus limiting the amount of product differentiation between manufacturers.

The use of different integrated circuits for each of the digital standards also adversely effects the telephone manufacturing process. As noted above, different market

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segments generally utilize different digital standards. For example, Europe is primarily based on the GSM standard, whereas the U.S. is primarily based on the IS54 standard. Therefore, for a company to participate in each of these various market segments for cellular telephones, the company is required to maintain multiple production flows, resources, reliability testing, packaging, port assembly and testing requirements for each of the digital standards that are supported. This necessarily leads to high manufacturing costs, which increases the cost of the overall system.

Therefore, an improved configurable architecture for digital communications applications is desired. More particularly, a new baseband architecture for digital communications is desired which provides reduced power consumption and more efficiency in executing the baseband operations of various digital communication standards. A new baseband architecture for digital communications is further desired which is easily configurable between different digital communications standards, thus simplifying the manufacturing process.

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Summary of the Invention

The present invention comprises a configurable multiprocessor communications architecture which performs various digital communications functions and which is configurable for different digital communications standards, such as various digital cellular standards. In the preferred embodiment, the multiprocessor architecture includes, preferably on a single integrated circuit, two or more digital signal processing cores, a microcontroller, a voice coder/decoder (codec), and a relatively low performance central processing unit. Each of the above devices are coupled to a system memory. The configurable digital communications architecture simplifies design and manufacturing costs and provides improved performance over prior designs.

In the preferred embodiment, the digital communications architecture includes one or more processor cores, preferably digital signal processors (DSPs), coupled through a system bus to a common DSP memory or system memory. The common DSP memory stores code and data used by the one or more DSPs. In one embodiment, two or more DSPs are connected to the system bus, and the two or more DSPs are also coupled through dedicated address and data buses. In this embodiment, the two or more DSPs communicate through the dedicated address and data buses without requiring system bus access. In another embodiment, two or more DSPs are daisy chained to the system bus, and one DSP performs system bus accesses for all of the daisy chained DSPs.

A micro-scheduler is coupled to the system bus and operates to schedule operations and/or functions of the one or more DSPs and the hardware acceleration logic. A general purpose CPU is also coupled to the system bus. The general purpose CPU preferably performs user interface functions and overall communications management functions, among others. A CPU local memory and various peripheral devices are coupled through a CPU local bus to the CPU. Specialized hardware acceleration logic, such as for encryption, may also be coupled to the system bus.

A dual port bus arbiter is preferably coupled between the CPU and the system bus and controls CPU access to the system bus and hence to the DSP memory or system memory. Thus the CPU gains access to the system bus and hence to the DSP memory through the dual port bus arbiter. The CPU local bus is preferably coupled between the

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CPU and the dual port bus arbiter to allow the CPU to access the CPU local memory and the various peripheral devices without having to access the main system bus. In this embodiment, other devices gain access to the CPU local memory through the dual port bus arbiter.

The CPU accesses the DSP memory to store code and data for use by other devices or to pass messages to the micro-scheduler through a semaphore in the memory. The CPU can also access the DSP memory to store code and data to set up operations which are to be performed by the DSPs under control of the micro-scheduler.

Once the micro-scheduler has received a task from the CPU, the micro-scheduler operates to assign different functions or tasks to the one or more DSPs and the hardware acceleration logic to perform the desired communication operation. During this time, the CPU generally does not have access to the system bus, but rather performs operations using its local CPU memory. The micro-scheduler preferably partitions tasks among each of the DSPs and the hardware acceleration logic to achieve the desired throughput while minimizing power consumption. The micro-scheduler also preferably dynamically controls the clock rates of each of the DSPs to achieve a desired computational throughput while minimizing power consumption.

The digital communications architecture of the present invention is configurable between different communications standards and also different communications applications. Thus, for a manufacturer of digital cellular devices, the digital communications architecture of the present invention can be easily programmed to operate according to the GSM standard, the IS54 standard, a CDMA standard, or a TDMA standard, among others. In addition, the digital communications architecture of the present invention can be easily programmed to operate as a digital cellular device, a cordless phone, or a personal communicator in a PCS system.

The configurable communications architecture of the present invention takes advantage of the synergy or commonality in algorithmic performance in the various digital cellular and digital communications standards. The present invention thus essentially provides a modular building block structure for constructing solutions for various digital cellular standards. According to the present invention, the hardware

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function units comprised in the architecture utilize a common interconnect, i.e. hardware platform, which remains constant. This hardware architecture is sufficiently flexible to be programmable to perform different functions and/or to operate according to different cellular standards. This removes the problems of the telephone manufacturer having to deal with multiple production and sourcing related issues.

The present invention thus provides a single architecture which has simplified configurability for different digital standards. This enables a reduction in telephone manufacturing costs and processes, in addition to simplified silicon design. In other words, the configurable architecture of the present invention utilizes a single hardware architecture for operating according to multiple different cellular standards, thus easing production and sourcing problems. In the preferred embodiment, the telephone manufacturer simply programs code for the appropriate wireless or wired digital cellular standard prior to shipping the final product.

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Brief Description of the Drawings

A better understanding of the present invention can be obtained when the following detailed description of the preferred embodiment is considered in conjunction with the following drawings, in which:

Figure 1 illustrates a digital communications device which includes a configurable digital cellular architecture according to the present invention;

Figure 2 is a block diagram of the configurable digital cellular architecture of the present invention;

Figure 3 is a more detailed block diagram of the configurable digital cellular architecture of the preferred embodiment;

Figure 4 is a flowchart diagram illustrating operation of the present invention; and

Figure 5 illustrates an alternate embodiment where the micro-scheduler is coupled to the CPU local bus;

Figure 6 illustrates an alternate embodiment where two sets of two DSPs are coupled to the system bus in a daisy chain fashion;

Figure 7 illustrates an alternate embodiment where two DSPs are coupled to the system bus and are also coupled through dedicated address and data lines; and

Figure 8 illustrates an alternate embodiment where two DSPs and the CPU are coupled to the system bus and are also coupled through dedicated address and data lines.

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Detailed Description of the Preferred Embodiment

Digital Communications Device

Referring now to Figure 1, a digital communications device 100 which includes the configurable digital architecture of the present invention is shown. In the preferred embodiment, the digital communications device 100 is a digital cellular device for wireless communications. However, the digital communications device may comprise other devices, as desired. As discussed below, the digital cellular device 100 is programmable to operate according to a variety of digital cellular standards, including the GSM standard, the IS54 standard, a CDMA standard, or a TDMA standard, among others. In addition, the digital communications architecture of the present invention can be easily programmed to operate as various digital communications devices, including a digital cellular device, a cordless phone, or a personal communicator in a PCS system, among others.

Configurable Architecture Block Diagram

Referring now to Figure 2, a block diagram illustrating a configurable multiprocessor architecture for digital communication applications is shown. The configurable multiprocessor architecture of the present invention is preferably configurable to operate according to various different digital standards, such as different digital cellular standards. It is noted that Figure 2 illustrates a portion of the hardware components comprised in the digital communications device 100, such as a digital cellular telephone. Also, the logic components shown in Figure 2 are preferably comprised on a single monolithic substrate and/or are preferably comprised as a single integrated circuit.

As shown, the communications device 100 includes a memory 202. The memory 202 stores program code and data which enables the communications device 100 to be configurable according to one or more of a plurality of different communication standards. For example, in the preferred embodiment, the memory 202 stores program

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code and data which enables the communications device 100 to operate according one or more of various digital cellular standards, such as GSM (group special mobile), IS54, and code division multiple access (CDMA), among others.

In one embodiment, the memory 202 is a multiport memory which includes a plurality of read/write ports. This allows multiple devices to simultaneously access the memory 202. In another embodiment, the memory 202 is a single port memory, and the system includes a dual port bus arbiter (Figure 3) which controls arbitration for the memory 202, as described further below.

As shown, the digital communications device 100 includes one or more digital signal processors 212 coupled to the memory 202 for performing communications functions. In the preferred embodiment of the invention, the architecture includes one or more first digital signal processors 212a which are configured or designated to perform transmit functions, and one or more digital signal processors 212b which are configured to perform receive functions. The embodiment of Figure 2 includes two first digital signal processors 212a and two second digital signal processors 212b. In the preferred embodiment, the digital communications device architecture includes only one first digital signal processor 212a which performs transmit functions and only one second digital signal processor 212b which performs receive functions.

Each of the DSPs 212 preferably comprises the ADSP 2171 core available from Analog Devices. In the preferred embodiment, the DSP core is preferably comprised of the ADSP 2171 core and includes certain architecture enhancements which provide improvements in the execution of algorithms or functions required for various digital communication standards. These architectural enhancements are discussed further below.

As shown, the system includes a microcontroller or micro-scheduler 222 which operates to control the operation of each of the transmit DSPs 212a and receive DSPs 212b. The micro-scheduler 222 performs scheduling operations to schedule operation of each of the DSPs 212. Micro-scheduler 222 also places the system in one or more desired modes, such as a parallel processing mode where each of the DSPs 212 are operating in parallel, or a master/slave mode where a first DSP 212 is designated as the master and the

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remaining DSPs 212 are designated as slave DSPs which receive tasks assigned by the master DSP.

Microcontroller 222 preferably is an efficient low power controller which operates as the central sequence or a task scheduler for the entire digital communications architecture. The sequencer or microcontroller 222 is preferably configured in a manner which allows the addition of computational units or DSPs without requiring a redesign of the sequencer or of memory hardware. According to the present disclosure, the term "computational units" is intended to include elements such as digital signal processing cores, custom logic, serial ports, and hardware acceleration logic, among others.

The microcontroller or sequencer 222 preferably controls each of the DSPs 212 and/or computational units in a manner which balances the computational throughput and power consumption based on the application being performed. Thus the microcontroller 222 preferably balances the tasks or functions assigned to each DSP 212 depending on the amount of computational throughput required. The microcontroller 222 also preferably controls the clock rate of each of the DSPs depending on the computational throughput and power consumption. Thus, for a computational intensive task which requires immediate response, the micro-scheduler 222 partitions the task among two or more DSPs or computational units, and operates the two or more DSPs or computational units at a full clock rate. For tasks which are not computationally intensive, the micro-scheduler 222 partitions the task among one or more of the DSPs or computational units, and operates the one or more DSPs or computational units at a slower clock rate to reduce power consumption.

In one embodiment, the microcontroller or sequencer 222 is an ARM-like processor, which acts as the central sequencer/controller. In this embodiment, software used to program the microcontroller 222 is preferably written in C or in similar higher level language using currently available development tools, i.e. C compilers, simulators, and debuggers. This provides a high level development platform for performing the design of the digital communications device, and also provides flexibility for changes or new features.

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The system preferably includes a general purpose CPU 250 which acts as the overall controller of the system. The CPU 250 comprised in the system of the present invention communicates with the micro-scheduler 222 and provides communications tasks to the micro-scheduler 222. The CPU 250 also preferably performs user interface functions, receiving and processing user commands. In one embodiment, the CPU 250 performs an intelligent multimode configurable communicator application. In other words, in one embodiment the CPU 250 executes an application which enables the digital communications device to operate according to different desired modes or digital standards. The CPU 250 also preferably implements various protocol stacks as appropriate due to the variability and the various standard specifications.

As shown, the digital communications system includes analog to digital conversion logic 230 and digital to analog conversion logic 232. The analog to digital (A/D) conversion logic 230 receives analog signals and provides corresponding digital signals to either one or more of the digital signal processors 212, 214, the CPU 250 or to the memory 202. The digital to analog (D/A) conversion logic 232 receives digital signals from the DSPs 212 or 214 or from the memory 202 and provides corresponding analog signals output from the communication device.

The digital communications device also preferably includes hardware acceleration logic for performing certain tasks and hardware. The hardware accelerator logic 240 preferably performs functions such as data coding or encryption, or other functions which require specialized or dedicated hardware.

Common Hardware for Different Digital Cellular Standards

As mentioned above, the configurable digital communications architecture shown in Figure 2 is configurable according to various communications standards. The present invention takes advantage of the commonality of functional requirements between each of the digital cellular standards.

In general, each digital cellular standard includes a baseband section comprising baseband logic for performing operations on the voice or data signals at the baseband frequency level. A typical baseband transmission block includes voice coding, channel

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coding, protocol handling, and modulation functions. Voice coding algorithms are generally based on code excited linear prediction methods. The voice coding algorithms used for each of the different cellular standards typically differ in bit rates, code books and error control used in the linear prediction voice coding algorithm. However, each of these voice coding algorithms are similar in execution and complexity from a computational standpoint. Channel coding and protocol stack functions are also similar in concept for each of the different digital cellular standards. However, differences exist in the length of the convolutional coding elements, trellis coding and viterbi decoding. The modulation used by the baseband sections of each of the digital cellular standards typically use well-known quaternary phase shift keying (QPSK) or GMSK modulation schemes.

Once voice signals have been digitized in a digital cellular voice call, the transmission flow resembles operation of a high speed modem. In a wired medium, the propagation channel is generally time invariant, whereas in the wired medium the propagation channel is time varying.

The design of the receiver station of both wired and wireless media generally has similar architecture features. However, the wireless receiver is generally far more complex in order to handle multipath fading characteristics of the channel. In analyzing the transmit and receive sections of a digital cellular architecture, it is apparent that the speech encoding algorithm in the transmit section requires the most computations and complexity. The receive section is dominated by channel equalization and viterbi estimation.

According to the configurable digital communication architecture of the present invention. the wireless and wired modem architectures are treated in a similar manner, thus producing a number of significant advantages. One advantage is that the transmission path can now be broken into two distinct sections, i.e., the transmit block can be treated as an independent block from the receive section.

As discussed above, prior art systems employ a single digital signal processor to execute the complete baseband functionality of a digital communications device. This inherently leads to high power consumption, high clock rates and excessive overhead in

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maintaining program flow and interrupts. Memory design also becomes an issue at higher clock rates.

The present invention provides a new communication architecture for digital communications which provides reduced power consumption and more efficiency in executing the baseband operations of various digital communication standards. As mentioned above, the system of the present invention includes two or more DSPs or computational units 212 and also includes a micro-scheduler 222 which dynamically assigns tasks and clock rates to achieve a desired computational throughput with reduced power consumption. This enables the use of lower clock rates in the system, thus reducing power requirements.

Also, by partitioning the communication functions, such as transmit and receive functions, between multiple processors, under the command of a controller, functional units in the digital communication system can operate in various modes, such as in a parallel processor mode or in a master/slave mode. Further, due to the use of multiple processors performing separate functions, the system can operate at lower clock rates which are sufficient to implement the required functionality. This enables power consumption to be controlled more easily. The present invention further includes circuit design techniques which further reduce power dissipation.

The multiprocessor architecture of the present invention also preferably utilizes one or more transmit digital signal processors 212a and one or more receive digital signal processors 212b. The transmit DSPs 212a perform the transmit function, whereas the receive DSPs 212b perform the receive function. Implementation of the transmit and the receive functions in different digital signal processors provides flexibility and scalability,

The overall architecture is also programmable or configurable according to various different digital communication standards and voice coding algorithms. This configurability allows the manufacturer to produce one hardware architecture which can then be configured according to various desired standards. This obviates the necessity of the telephone manufacturer having to deal with multiple production and sourcing related issues.

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Figure 3 - Block Diagram

Referring now to Figure 3, a more detailed block diagram illustrating the preferred embodiment of the invention is shown. Elements in Figure 3 which are similar or identical to elements in Figure 2 have the same reference numerals for convenience. The elements or components shown in Figure 3 are preferably all comprised on a single monolithic silicon substrate and/or are preferably comprised as a single integrated circuit.

As shown, the digital communications system includes one or more processor cores 212 coupled through a bus 214 to a common DSP memory or system memory 202. The processor cores 212 are preferably digital signal processors, although other types of processor units may be used. In the preferred embodiment, the system includes two DSPs 212, although a greater or lesser number of DSPs may be used.

Specialized hardware acceleration logic 240 may also be coupled to the bus 214. The hardware acceleration logic 240 is included to perform certain functions in dedicated hardware due to computational requirements. In the preferred embodiment, the hardware acceleration logic 240 performs data encryption operations.

Microcontroller or micro-scheduler 222 is coupled to the bus 214 and operates to schedule operations and/or functions of the one or more DSPs 212 and the hardware acceleration logic 240. A general purpose CPU 250 is also coupled to the bus 214. The general purpose CPU 250 preferably performs user interface functions and overall communications management functions, among others.

The digital communications system includes analog to digital conversion logic 230 and digital to analog conversion logic 232. The analog to digital (A/D) conversion logic 230 receives analog signals and provides corresponding digital signals to either one or more of the digital signal processors 212, 214, the CPU 250 or to the memory 202. The digital to analog (D/A) conversion logic 232 receives digital signals from the DSPs 212 or 214 or from the memory 202 and provides corresponding analog signals output from the communication device. The A/D logic 230 and the D/A logic 232 are primarily used for converting analog speech signals to digital signals, and for converting digital

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speech signals to analog speech signals. In one embodiment, the A/D logic 230 and the D/A logic 232 are comprised in a voice coder / decoder (codec).

The common DSP memory or system memory 202 stores code and data used by the one or more DSPs 212, as well as for the hardware acceleration logic 240, the micro-scheduler 222, and the CPU 250.

A non-volatile memory 203 is coupled to the system memory 202 and stores code and data necessary to implement one or more digital cellular standards. Code and data is programmed into the non-volatile memory 203 by the manufacturer to program or configure the system according to a desired digital standard, such as a digital cellular standard. At power-up, the code and data from the non-volatile memory 203 is preferably transferred to the system memory 202 for use within the system. In one embodiment, code and data for two or more digital cellular standards are programmed into the non-volatile memory 203, and the user can selectively configure the digital communications device according to one of these desired digital cellular standards, depending on the location where the device is used.

A bus arbiter 252, referred to as a dual port bus arbiter 252, is preferably coupled between the CPU 250 and the bus 214 and controls access to the bus 214 and hence to the system memory 202. A CPU local memory 262 and various peripheral devices 264 are coupled through a CPU local bus 260 to the CPU 250. The CPU local bus 260 is coupled between the CPU 250 and the dual port bus arbiter 252 to allow the CPU 250 to access the CPU local memory 262 and the various peripheral devices 264 without having to access the main system bus 214. The non-volatile memory 203 may be coupled to the CPU local memory 262 for providing code and data to the CPU local memory 262 during power-on. As mentioned above, the non-volatile memory 203 stores code and data which allows the digital communications device to operate according to a desired digital cellular standard.

As mentioned above, the dual port bus arbiter 252 controls access to the system bus 214 and hence to the system memory or DSP memory 202. The CPU 250 accesses the system memory 202 to store code and data for use by other devices or to pass messages to the micro-scheduler 222 through a semaphore in the system memory 202.

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The CPU 250 also accesses the DSP memory 202 to store code and data to set up operations which are to be performed by the DSPs 212 under control of the micro-scheduler 222.

Once the micro-scheduler 222 has received a task from the CPU 250, the micro-scheduler operates to assign different functions or tasks to the one or more DSPs 212 and the hardware acceleration logic 240 to perform the desired communication operation. During this time, the CPU 250 generally does not have access to the system bus 214, but rather performs operations using its local CPU memory 262. Thus, after the CPU 250 accesses the memory 202 to set up a transmit or receive operation, the micro-scheduler 222 gains access to the bus 214 to access the memory 202 and assign tasks to different DSPs 212. The CPU 250 operates out of its CPU local memory 262 during this time that it is "locked out" of the memory 202.

Thus the dual port bus arbiter 252 controls access to the system bus 214 and hence to the DSP memory 202. Once the CPU 250 has set up an operation and relinquished control to the micro-scheduler 222, the dual port bus arbiter 252 controls access to the system bus 214 between the micro-scheduler 222, the DSPs 212, and the hardware acceleration logic 240.

In one embodiment, the dual port bus arbiter 252 also controls access to the CPU local memory 262 from other devices, such as the micro-scheduler 222. Thus when the micro-scheduler 222 desires to read or write a location in the CPU local memory 262, the micro-scheduler 222 requests access to the CPU local bus 260 through the dual port bus arbiter 252. The CPU 250 has priority access to the CPU local bus 260.

The digital communications architecture of the present invention is configurable between different communications standards and also different communications applications. Thus, for a manufacturer of digital cellular devices, the digital communications architecture of the present invention can be easily programmed to operate according to the GSM standard, the IS54 standard, a CDMA standard, or a TDMA standard, among others. In addition, the digital communications architecture of the present invention can be easily programmed to operate as a digital cellular device, a cordless phone, or a personal communicator in a PCS system.

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The configurable multiprocesser architecture of the present invention takes advantage of the synergy or commonality in algorithmic performance in the various digital cellular and digital communications standards. The present invention thus essentially provides a modular building block structure for constructing solutions for various digital cellular standards. According to the present invention, the hardware function units comprised in the architecture utilize a common interconnect, i.e. hardware platform, which remains constant. This hardware architecture is sufficiently flexible to be programmable to perform different functions and/or to operate according to different cellular standards. This removes the problems of the telephone manufacturer having to deal with multiple production and sourcing related issues.

Flowchart Diagram

Referring now to Figure 4, a flowchart diagram illustrating operation of the preferred embodiment of the present invention is shown.

As shown, in step 402 the CPU writes code and data to the system memory 202 to configure the microcontroller 222 to perform desired functions. Thus in step 402 the CPU 250 sets up a communications function, such as a transmit or receive function, by writing the appropriate code and data to the system memory 202. This code and data provides the necessary information which enables the microcontroller 222 to begin a communications function.

In step 404 the microcontroller 222 accesses the code and data written by the CPU 250 from the system memory 202. In step 406 the microcontroller selectively assigns functions to the one or more digital signal processors 212 based on the code and data written by the CPU 250. Thus the microcontroller or micro-scheduler 222 acts to assign functions or tasks to one or more of the DSPs based on the function being performed. In step 408 the one or more digital signal processors 212 perform digital communications functions in response to the microcontroller 222 selectively assigning functions to the one or more digital signal processors 212. It is noted that, during this time, the CPU 250 accesses code and data from the CPU local memory 262 in step 410. Thus the micro-scheduler 222 acts to assign functions or tasks to the one or more of the DSPs in step 408

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substantially contemporaneously with the CPU 250 accessing code and data from the CPU local memory 262 in step 410.

The microcontroller 222 preferably selectively assigns tasks to each of the one or more digital signal processors 212 to attain a desired computational throughput while also minimizing power consumption. Each of the one or more digital signal processors is configurable to operate at one of a plurality of different clock rates. In the preferred embodiment, the microcontroller 222 selectively controls the clock rates of each of the one or more digital signal processors 212 to reduce or minimize power consumption. Thus, the microcontroller 222 may assign a task to only one DSP 212 and operate the DSP 212 at its full clock rate to perform the task. The microcontroller 222 may also partition the task between two or more of the DSPs 212 and operate each of the DSPs 212 at half their full clock rate to perform the task in order to reduce power consumption.

Programming the System according to a Desired Digital Standard

In order to program the hardware system of Figure 3 according to a desired digital communications standard, such as a digital cellular standard, code and data is stored or written into non-volatile memory 203 which is coupled to the system memory 202. The code and data stored in the non-volatile memory 203 is in accordance with the digital standard. Thus, if it is desired to program the system for the GSM digital cellular standard, code and data is programmed into the non-volatile memory 203 which performs operations according to this digital standard. Upon power-up, the code and data stored in the non-volatile memory 203 is transferred to the system memory 202 for use in the system. Code and data stored in the non-volatile memory 203 may also be transferred to the CPU local memory 262 for execution by the CPU. Alternatively, a separate non-volatile storage memory (not shown) is coupled to the CPU local memory 262 for providing code and data to the CPU local memory 262 during power-up.

Figure 5 - Micro-scheduler coupled to CPU Local Bus (Alternate Embodiment)

Referring now to Figure 5, an alternate embodiment of the invention is shown. In the embodiment of Figure 5, the micro-scheduler or microcontroller 222 is coupled to the

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CPU local bus 260. This enables the CPU 250 and the microcontroller 222 to communicate on the CPU local bus 260, thus freeing up the system bus 214 for use by the DSPs 212. The microcontroller 222 accesses the system bus 214 and hence the system memory 202 through the dual port bus arbiter 252. The microcontroller 222 preferably uses the CPU local memory 262 for operations and writes code and data to the system memory 202 to assign functions or tasks to the DSPs 212.

Figure 6 - DSP Daisy Chain Embodiment

Referring now to Figure 6, an alternate embodiment of the invention is shown. In the embodiment of Figure 6, two or more DSPs 212 are coupled to the system bus 214 in a daisy chain format. In other words, a first DSP 212 is coupled to the system bus 214, and a second DSP 212 is coupled to the first DSP 212. In the embodiment of Figure 6, two sets or groups of first and second DSPs are shown coupled to the system bus 214. For each group of first and second DSPs, the first DSP 212 accesses code and data from the system memory 202 that is required for both of the first and second DSPs 212. This limits the required accesses to the system bus 214 and hence to the system memory 202.

Thus, in this embodiment, only the first DSP 212 in a group of two or more DSPs is assigned a task by the microcontroller 222. In response, the first DSP 212 reads code and data from the system memory 202 that is required for both of the first and second DSPs 212 in the group. The first DSP 212 then partitions tasks between the first and second DSPs 212. The first and second DSPs 212 operate in either a parallel processing mode or a master/slave mode to accomplish the assigned task, using the code and data retrieved by the first DSP 212.

Figure 7 - Dedicated DSP Buses (Alternate Embodiment)

Referring now to Figure 7, an alternate embodiment of the invention is shown. In the embodiment of Figure 7, two or more DSPs 212 are coupled to the system bus 214, and the system includes dedicated address and data buses coupled between the two or more DSPs 212. This enables the two or more DSPs 212 to communicate via the dedicated address and data buses without having to access the system bus. For example,

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this facilitates the operation of the two or more DSPs 212 in a master/slave mode or a parallel processing mode. For more information on this embodiment, please see EPO patent number 0465054, and U.S. Patent application Serial No. 07/548,709, which are both hereby incorporated by reference as though fully set forth herein.

In one embodiment of the invention, each of the DSPs 212 include a separate local memory (not shown), and each of the DSPs 212 execute code and data out of their respective local memories. This reduces the arbitration and contention for the system memory 202. The DSP local memories in this embodiment are also used for communication between each of the DSPs, using the dedicated address and data buses.

Figure 8 - Dedicated Buses Between DSPs and CPUs (Alternate Embodiment)

Referring now to Figure 8, an alternate embodiment of the invention is shown. In the embodiment of Figure 7, two or more DSPs 212 are coupled to the system bus 214, and the system includes dedicated address and data buses coupled between the two or more DSPs 212 and the CPU 250. This enables the two or more DSPs 212 and the CPU 250to communicate via the dedicated address and data buses without having to access the system bus.

In another embodiment (not shown), the system includes dedicated address and data buses coupled between the two or more DSPs 212 and the micro-scheduler 222. This enables the micro-scheduler 222 to more easily assign tasks, such as passing commands and data, to the two or more DSPs 212.

DSP Functional Enhancements to the ADSP Architecture

In the preferred embodiment, each of the DSPs 212 comprises the ADSP 2171 core available from Analog Devices. As noted above, in the preferred embodiment the DSP core is preferably comprised of the ADSP 2171 core and includes certain architecture enhancements which provide improvements in the execution of algorithms or functions required for various digital communication standards. These architectural enhancements are listed below.

1. Shadowing of Address Generation Registers.

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2. Shadowing of all Registers to 2 levels.
3. Register File to separate Dual Memories from Functional Units.
4. Using a register file to separate dual memories from functional units allows Parallel Operation of Functional Units, including pipelining the ALU with the MAC and pipelining the ALU with the Shifter. This also supports Table Search Algorithms.
5. Exploit Internal DRAM spare cycles for Data I/O.
6. Enhanced Instructions to Support Channel Coding/Decoding: Data Compare and Pointer Save.
7. Post and Pre scaling for MAC operations to allow easier Data Normalisation.

These features are added to the ADI Architecture at a cost of increasing Instruction word length and memory architecture. Also, the ability to add/subtract functional units tailored to particular applications and modifying the instruction set accordingly provides a more modular approach to the DSP Architecture and allows cost-effective solutions in price-sensitive markets. Support tools may also be provided to cover these enhancements to allow ease of programmability for embedded applications.

Conclusion

The present invention thus provides a single architecture which has simplified configurability for different digital standards. This enables a reduction in telephone manufacturing costs and processes, in addition to simplified silicon design. In other words, the configurable architecture of the present invention utilizes a single hardware architecture for operating according to multiple different cellular standards, thus easing production and sourcing problems. In the preferred embodiment, the telephone manufacturer simply programs code for the appropriate wireless or wired digital cellular standard prior to shipping the final product.

Although the system and method of the present invention has been described in connection with the preferred embodiment, it is not intended to be limited to the specific form set forth herein, but on the contrary, it is intended to cover such alternatives,

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modifications, and equivalents, as can be reasonably included within the spirit and scope of the invention as defined by the appended claims.

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In the Claims:

1. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, the digital wireless communication system comprising, on a single integrated circuit:

a system bus for transmitting data;

system memory coupled to the system bus for storing code and data;

one or more digital signal processors (DSPs) coupled to the system bus for performing communication functions;

a microcontroller coupled to said system bus which controls operations of said one or more digital signal processors, wherein the microcontroller is configured to access code and data from the system memory, wherein the microcontroller is configured to control operations of the one or more digital signal processors;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled to the system bus which controls arbitration and access to the system bus, wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU;

a CPU local memory coupled to the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations.

2. The digital wireless communication system of claim 1, wherein the bus arbiter is coupled between the system bus and the CPU, wherein the CPU local memory is coupled between the dual port bus arbiter and the CPU, wherein the bus arbiter is a dual port bus arbiter, wherein the dual port bus arbiter is also configured to receive requests from each of the microcontroller and the CPU for access to the CPU local

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memory, wherein the dual port bus arbiter selectively grants access to the CPU local memory to one of either the microcontroller or the CPU.

3. The digital wireless communication system of claim 1, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

4. The digital wireless communication system of claim 1, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

5. The digital wireless communication system of claim 1, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

6. The digital wireless communication system of claim 1, wherein the CPU is operable to access code and data from the CPU local memory while the microcontroller accesses code and data from the system memory.

7. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, comprising, on a single integrated circuit:

a system bus for transmitting code and data;

system memory coupled to the system bus for storing code and data;

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one or more digital signal processors (DSPs) coupled to the system bus for performing communication functions;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled between the system bus and the CPU which controls arbitration and access to the system bus;

a CPU local bus coupled between the CPU and the bus arbiter;

a CPU local memory coupled to the CPU local bus, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations; and

a microcontroller coupled to the CPU local bus which controls operations of said one or more digital signal processors, wherein the microcontroller is configured to access code and data from the CPU local memory, wherein the microcontroller is configured to control operations of the one or more digital signal processors;

wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU.

8. The digital wireless communication system of claim 7, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

9. The digital wireless communication system of claim 7, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

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10. The digital wireless communication system of claim 7, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

11. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, the digital wireless communication system comprising, on a single integrated circuit:

a system bus for transmitting data;

system memory coupled to the system bus for storing code and data;

at least two digital signal processors (DSPs) coupled to the system bus for performing communication functions;

one or more address/data buses coupled between the at least two DSPs for communicating data between the at least two DSPs;

a microcontroller coupled to said system bus which controls operations of said at least two digital signal processors, wherein the microcontroller is configured to access code and data from the system memory, wherein the microcontroller is configured to control operations of the at least two digital signal processors;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled to the system bus which controls arbitration and access to the system bus, wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU;

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a CPU local memory coupled to the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations.

12. The digital wireless communication system of claim 11, wherein the bus arbiter is coupled between the system bus and the CPU, wherein the CPU local memory is coupled between the dual port bus arbiter and the CPU, wherein the bus arbiter is a dual port bus arbiter, wherein the dual port bus arbiter is also configured to receive requests from each of the microcontroller and the CPU for access to the CPU local memory, wherein the dual port bus arbiter selectively grants access to the CPU local memory to one of either the microcontroller or the CPU.

13. The digital wireless communication system of claim 11, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

14. The digital wireless communication system of claim 11, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

15. The digital wireless communication system of claim 11, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

16. The digital wireless communication system of claim 11, further comprising:

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one or more address/data buses coupled between one or more of the DSPs and the CPU for communicating data between one or more of the DSPs and the CPU.

17. A digital wireless communication system for performing communications according to one of a plurality of different digital standards, wherein the system is configurable to operate according to different ones of said plurality of digital standards, the digital wireless communication system comprising, on a single integrated circuit:

a system bus for transmitting data;

system memory coupled to the system bus for storing code and data;

a first digital signal processor (DSP) coupled to the system bus for performing communication functions;

a second DSP coupled to the first DSP, wherein the second DSP is not directly connected to the system bus, wherein the first DSP performs system memory accesses to retrieve code and data used by both of the first and second DSPs;

a microcontroller coupled to said system bus which controls operations of said at least two digital signal processors, wherein the microcontroller is configured to access code and data from the system memory, wherein the microcontroller is configured to control operations of the at least two digital signal processors;

a voice coder/decoder (codec) coupled to the system bus, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic;

a central processing unit (CPU) coupled to the system bus, wherein the CPU implements one of a plurality of possible protocol stacks for digital communication;

a bus arbiter coupled to the system bus which controls arbitration and access to the system bus, wherein the bus arbiter is configured to receive requests from each of the microcontroller and the CPU for access to the system bus and selectively grant control of the system bus to one of either the microcontroller or the CPU;

a CPU local memory coupled to the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations.

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18. The digital wireless communication system of claim 17, wherein the microcontroller is configured to selectively assign tasks to each of said one or more digital signal processors to attain a desired computational throughput.

19. The digital wireless communication system of claim 17, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, wherein the microcontroller is configured to selectively control the clock rates of each of said one or more digital signal processors to reduce power consumption.

20. The digital wireless communication system of claim 17, wherein the CPU is operable to write code and data to the system memory to configure the microcontroller to perform desired functions;

wherein the microcontroller is configured to read said code and data written by the CPU and selectively assign functions to the one or more digital signal processors based on said code and data written by the CPU.

21. A method for performing digital communications functions in a digital communications device comprising a system memory, one or more digital signal processors (DSPs) coupled to the system memory, a microcontroller coupled to the system memory, and a CPU coupled to the system memory, the method comprising:

the CPU writing code and data to the system memory to configure the microcontroller to perform desired functions;

the microcontroller accessing the code and data written by the CPU;

the microcontroller selectively assigning functions to the one or more digital signal processors based on said code and data written by the CPU; and

the one or more digital signal processors performing digital communications functions in response to the microcontroller selectively assigning functions to the one or more digital signal processors.

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22. The method of claim 21, wherein the digital communications device further includes a dual port bus arbiter coupled to the system memory which controls arbitration and access to the system memory, the method further comprising:

the dual port bus arbiter receiving requests from each of the microcontroller and the CPU for access to the system bus; and

the dual port bus arbiter selectively granting control of the system bus to one of either the microcontroller or the CPU.

23. The method of claim 21, wherein the digital communications device further includes a CPU local memory coupled between the dual port bus arbiter and the CPU, wherein the CPU local memory stores code and data used by the CPU for performing communication control operations, the method further comprising:

the dual port bus arbiter receiving requests from each of the microcontroller and the CPU for access to the CPU local memory; and

the dual port bus arbiter selectively granting access to the CPU local memory to one of either the microcontroller or the CPU based on said received requests.

24. The method of claim 21, further comprising:

the microcontroller selectively assigning tasks to each of said one or more digital signal processors to attain a desired computational throughput.

25. The method of claim 21, wherein each of said one or more digital signal processors is configurable to operate at a clock rate, the method further comprising:

the microcontroller selectively controlling the clock rates of each of said one or more digital signal processors to reduce power consumption.

26. The method of claim 21, further comprising:

the CPU accessing code and data from the CPU local memory during said microcontroller accessing the code and data written by the CPU.

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27. A system for performing communications according to one of a plurality of different digital standards, comprising:

memory for storing code and data;

a first digital signal processor coupled to the memory for performing transmit functions, wherein the digital signal processor which performs transmit functions performs voice coding functions, channel coding functions, protocol handling functions, and modulation functions;

a second digital signal processor coupled to the memory for performing receive functions, wherein the digital signal processor which performs receive functions performs channel equalization functions and signal estimation functions;

a microcontroller coupled to said first digital signal processor which performs transmit functions and also coupled to said second digital signal processor which performs receive functions, wherein the microcontroller is configured to control operations of the first digital signal processor and the second digital signal processor;

a voice coder/decoder (codec) coupled to each of the first digital signal processor and the second digital signal processor, wherein the voice codec includes analog to digital conversion logic and digital to analog conversion logic; and

a central processing unit coupled to the memory, wherein the central processing unit implements one of a plurality of possible protocol stacks for digital communication.

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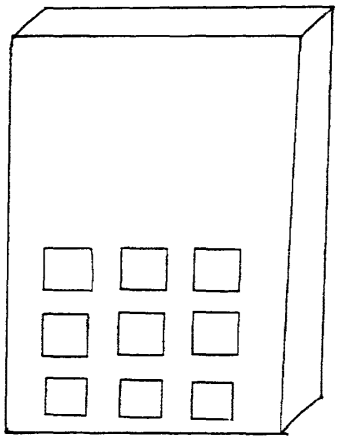


Figure 1

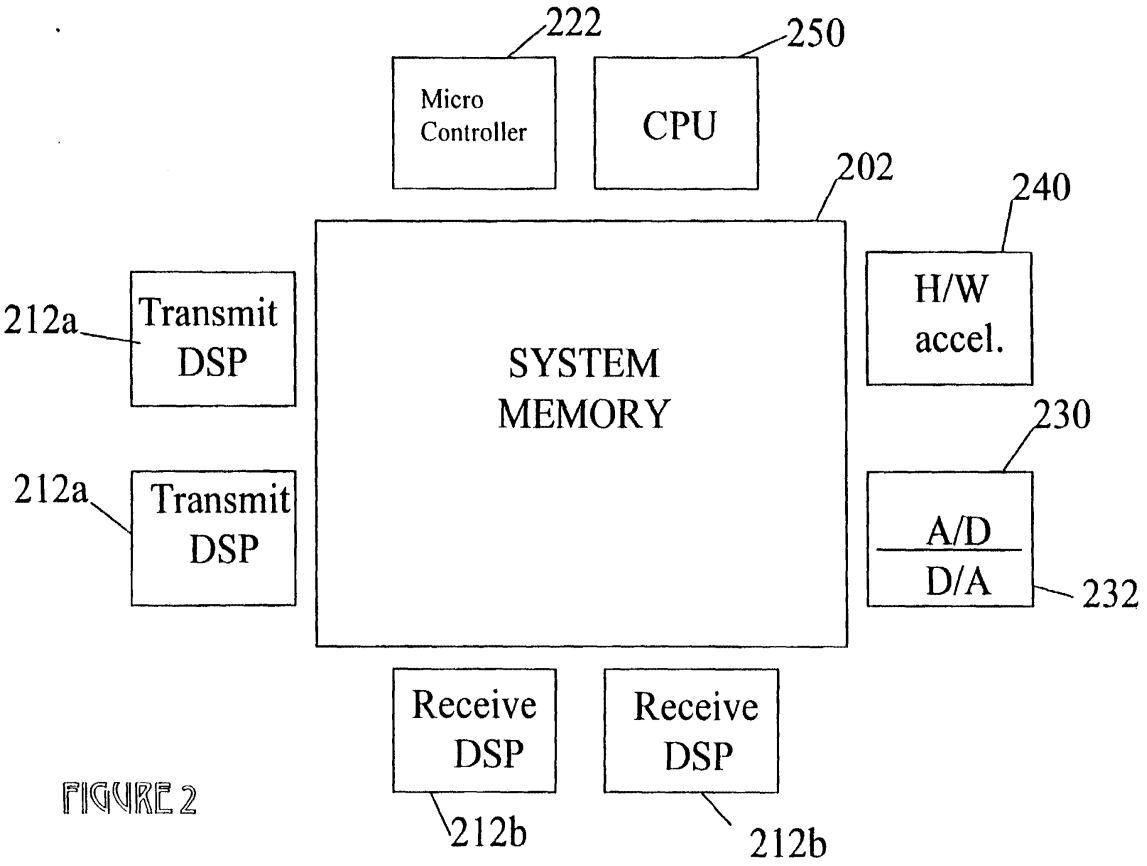

222
250
Micro Controller
CPU
202
240
212a
Transmit DSP
SYSTEM MEMORY
H/W accel.
230
212a
Transmit DSP
A/D
D/A
232
Receive DSP
Receive DSP
212b
212b

FIGURE 2

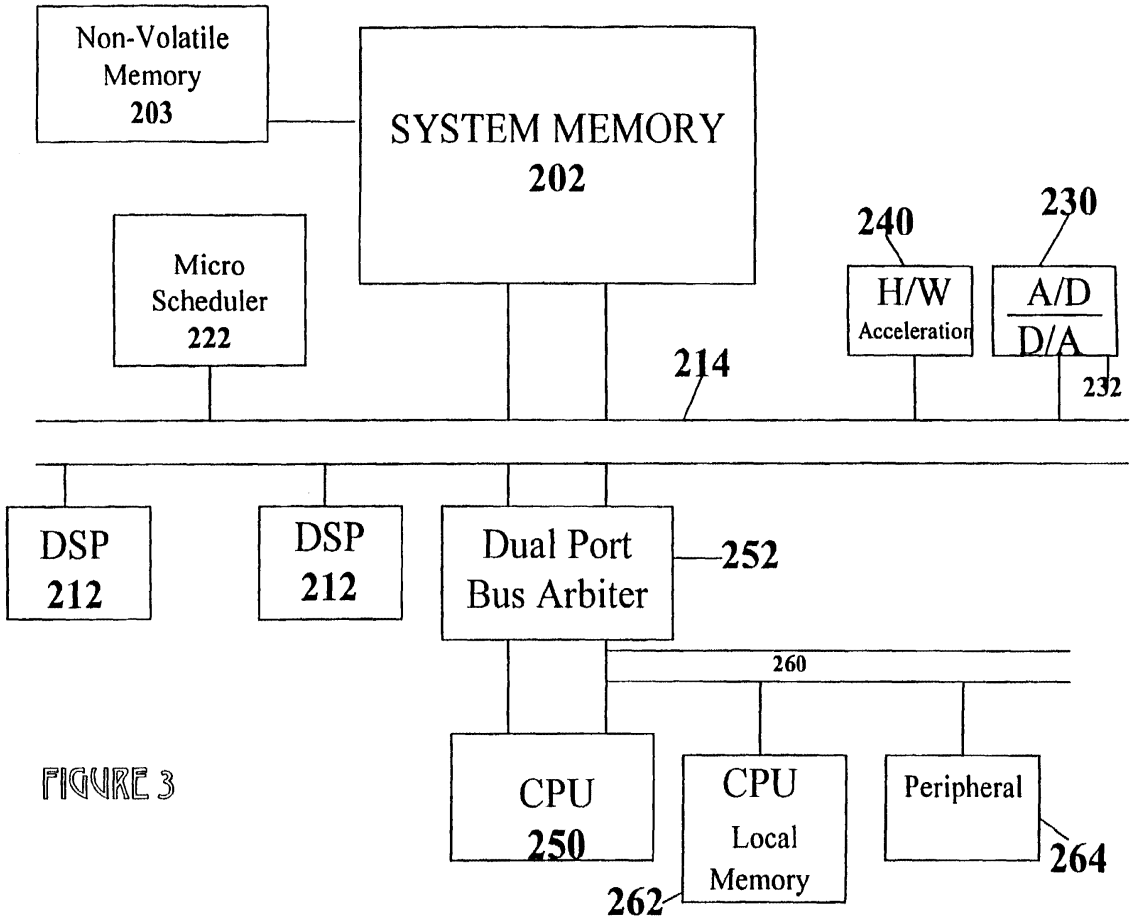

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
230
H/W Acceleration
A/D
D/A
232
214
DSP 212
DSP 212
Dual Port Bus Arbiter
252
260
CPU 250
CPU Local Memory
262
Peripheral
264

FIGURE 3

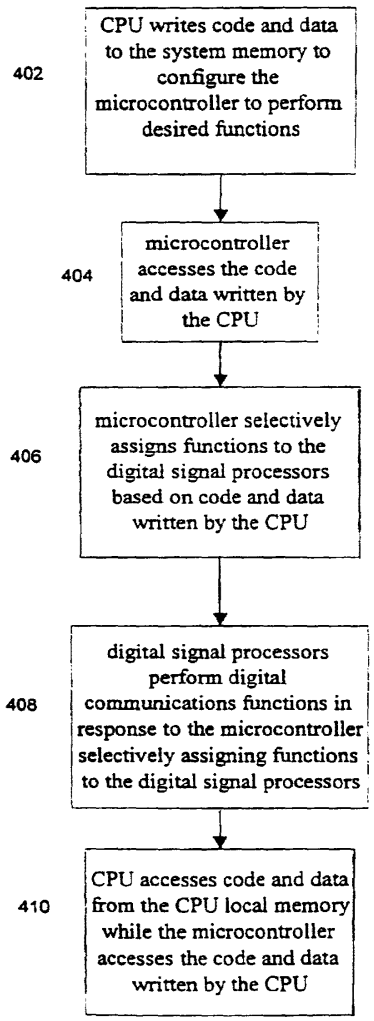

402
CPU writes code and data to the system memory to configure the microcontroller to perform desired functions
404
microcontroller accesses the code and data written by the CPU
406
microcontroller selectively assigns functions to the digital signal processors based on code and data written by the CPU
408
digital signal processors perform digital communications functions in response to the microcontroller selectively assigning functions to the digital signal processors
410
CPU accesses code and data from the CPU local memory while the microcontroller accesses the code and data written by the CPU

Figure 4

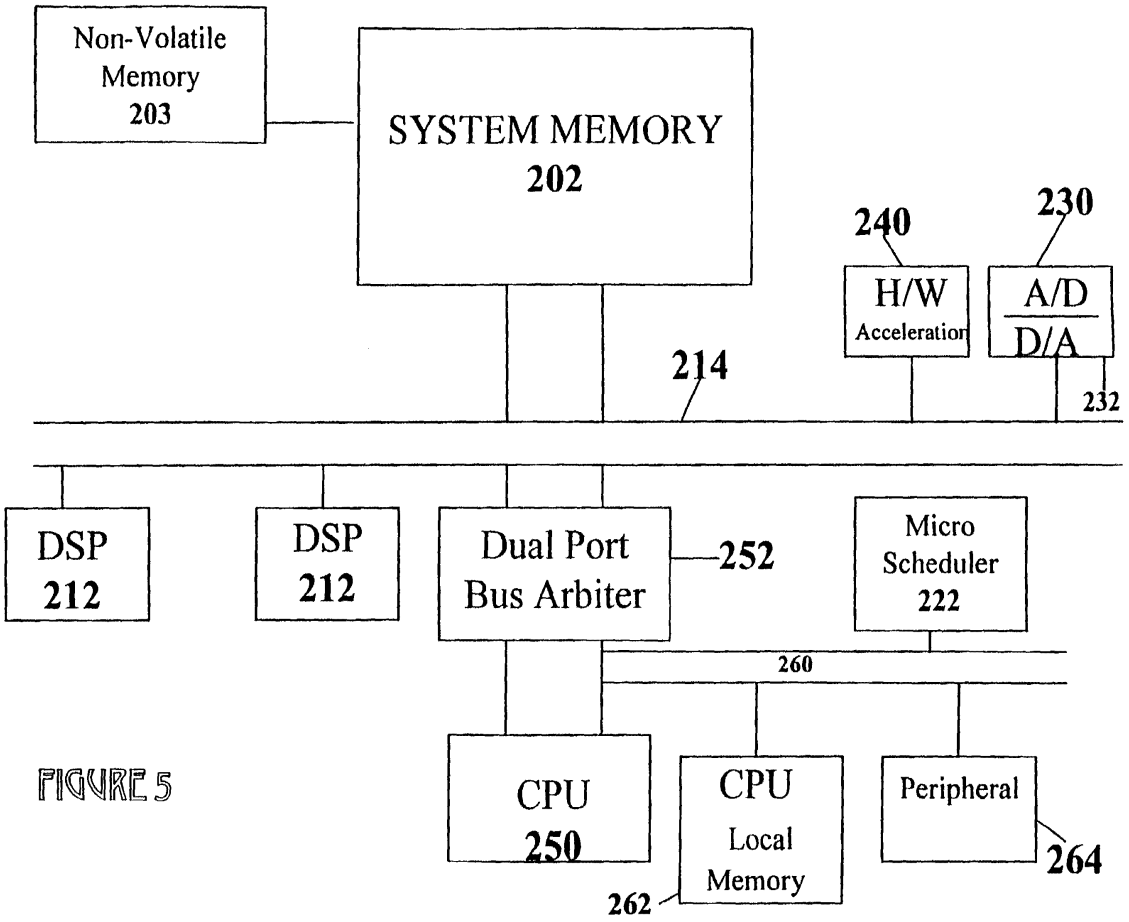

Non-Volatile Memory 203
SYSTEM MEMORY 202
240
H/W Acceleration
230
A/D
D/A
214
232
DSP 212
DSP 212
Dual Port Bus Arbiter
252
Micro Scheduler 222
260
CPU 250
CPU Local Memory
262
Peripheral
264

FIGURE 5

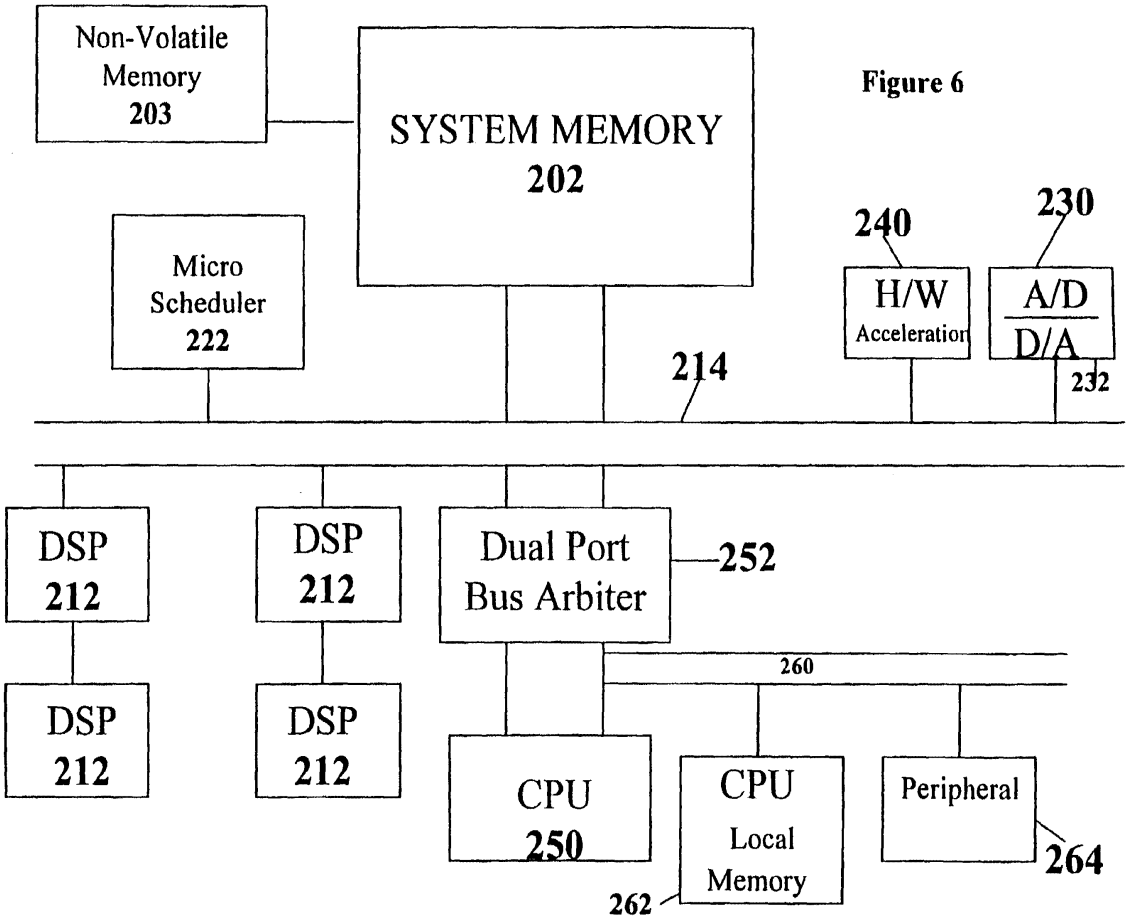

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
H/W Acceleration
230
A/D
D/A
232
214
DSP 212
DSP 212
DSP 212
DSP 212
Dual Port Bus Arbiter
252
260
CPU 250
CPU Local Memory
262
Peripheral
264

Figure 6

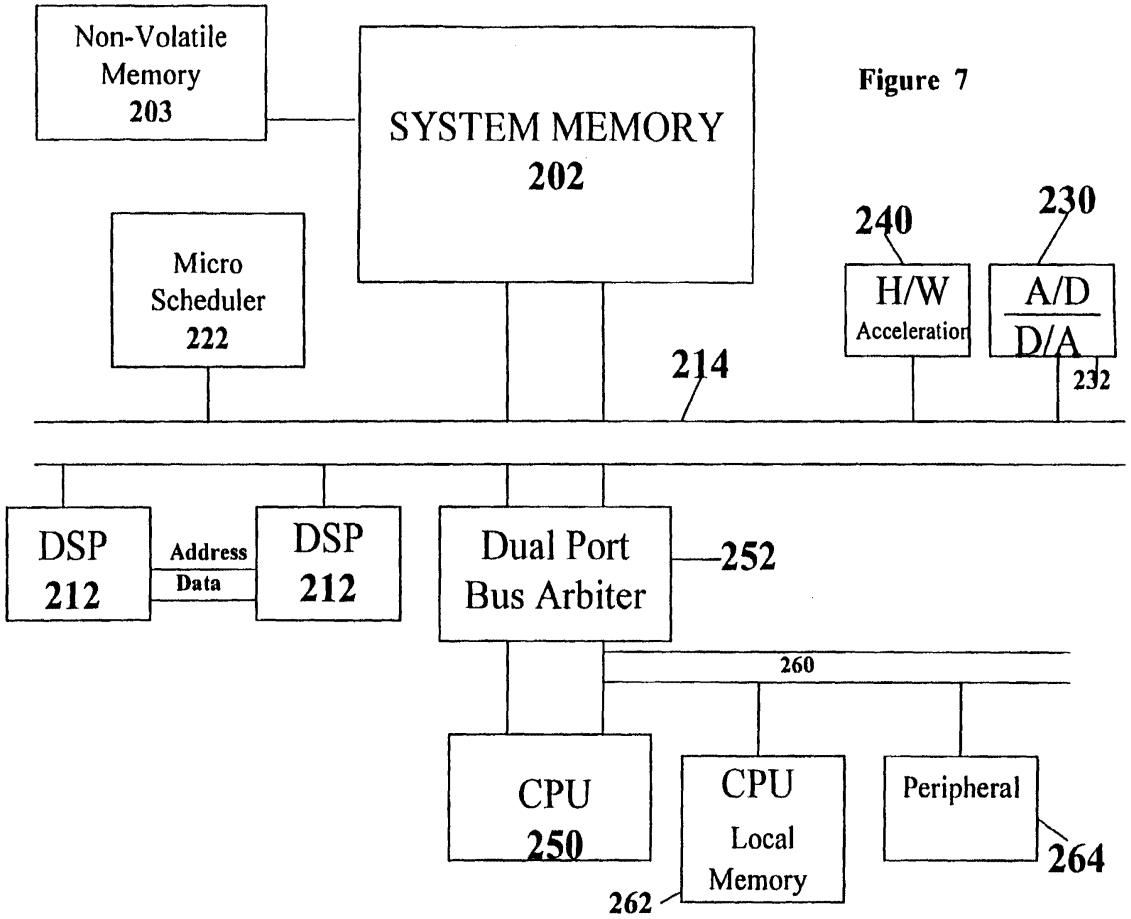

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
H/W Acceleration
230
A/D
D/A
232
214
DSP 212
Address
Data
DSP 212
Dual Port Bus Arbiter
252
260
CPU 250
CPU Local Memory
262
Peripheral
264

Figure 7

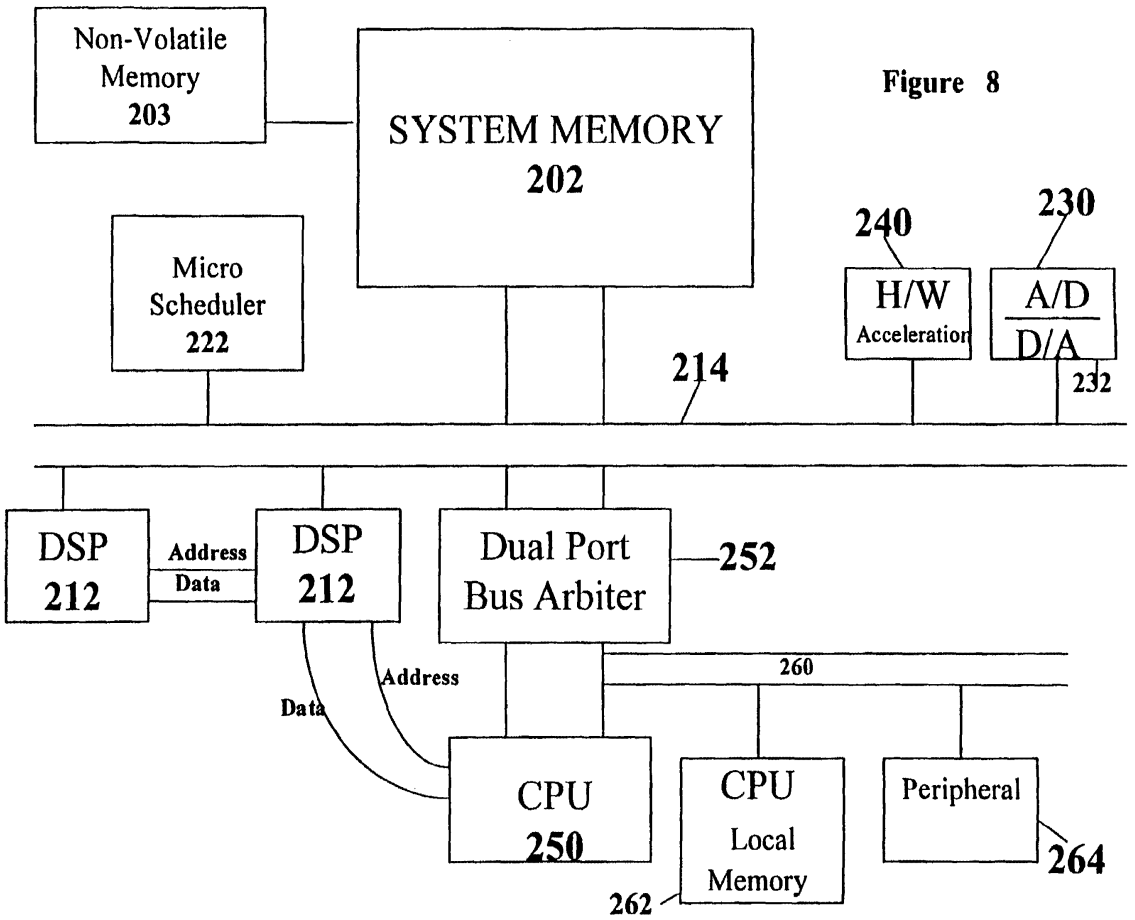

Non-Volatile Memory 203
SYSTEM MEMORY 202
Micro Scheduler 222
240
H/W Acceleration
230
A/D
D/A
232
214
DSP 212
Address
Data
DSP 212
Dual Port Bus Arbiter
252
260
Address
Data
CPU 250
CPU Local Memory
262
Peripheral
264

Figure 8

INTERNATIONAL SEARCH REPORT

Inter ›nal Application No
PCT/US 97/17150

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/32 H04B1/40

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)
IPC 6 H04Q H04B H04M

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 664 632 A (ADVANCED MICRO DEVICES INC) 26 July 1995 see column 1, line 1 - column 6, line 34 see column 8, line 18 - column 16, line 53 see column 18, line 44 - column 19, line 1 see column 20, line 45 - column 21, line 7 see figures 2A,2B	21,24,25
A		1,7,11, 17,27

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts 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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
11 February 1998	19/02/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Vaskimo, K

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INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 97/17150

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category '	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	LACKEY R J ET AL: "SPEAKEASY: THE MILITARY SOFTWARE RADIO" IEEE COMMUNICATIONS MAGAZINE, vol. 33, no. 5, 1 May 1995, pages 56-61, XP000518771 see page 56, left-hand column, line 13 - right-hand column, line 33 see page 57, left-hand column, line 46 - right-hand column, line 9 see page 58, left-hand column, line 2 - page 60, line 55 ---	1,7,11, 17,21,27
A	STEELE R ET AL: "THIRD GENERATION PCN AND THE INTELLIGENT MULTIMODE MOBILE PORTABLE" ELECTRONICS AND COMMUNICATION ENGINEERING JOURNAL, vol. 5, no. 3, 1 June 1993, pages 147-156, XP000377790 see abstract see paragraph 1 see paragraph 3 see paragraph 13 ---	1,7,11, 17,21,27
A	EP 0 580 341 A (ADVANCED MICRO DEVICES INC ;SONY CORP (JP)) 26 January 1994 see page 2, line 24 - line 27 see page 3, line 8 - page 4, line 17 see page 5, line 8 - line 11 see page 6, line 8 - page 7, line 20 see page 7, line 56 - page 13, line 33 ---	1,7,11, 17,21,27
A	US 5 465 409 A (BORRAS JAIME A ET AL) 7 November 1995 see the whole document ---	1,7,11, 17,21,27
A	US 4 718 057 A (VENKITAKRISHNAN P ET AL) 5 January 1988 see abstract -----	1,7,11, 17,21,27

1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte: onal Application No
PCT/US 97/17150

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		JP 6052951 B	06-07-94
		JP 62053589 A	09-03-87

Form PCT/ISA/210 (patent family annex) (July 1992)

Electronic Acknowledgement Receipt	
EFS ID:	9686809
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	George S. Blasiak/Nicole Pruett
Filer Authorized By:	George S. Blasiak
Attorney Docket Number:	H0022017
Receipt Date:	18-MAR-2011
Filing Date:	25-SEP-2009
Time Stamp:	10:48:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	283_687_-_Transmittal_PTO_SB-21_-_03_15_11.pdf	29336 71d13d13e4cdfc810015d772f924839e7a7a2805	no	1
Warnings:					
Information:					

2	Information Disclosure Statement (IDS) Filed (SB/08)	283_687_-_Information_Disclosure_Statement_By_Applicant_PTO_SB-08_-_03_15_11.pdf	46639 1adad5b4e8e4e9445799ae1dda628b4cef5619f8	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	283_687_-_Information_Disclosure_Statement_Supplemental_--_Foreign_Search_-_03_15_11.pdf	22153 5ba2c38d150c1a3c3a6f0c949838b3285d9a4d14	no	3
Warnings:					
Information:					
4	Foreign Reference	BA.pdf	2108385 40a58359e3376878e2504869b99a6621fa0aa7f8	no	44
Warnings:					
Information:					
5	NPL Documents	CA.pdf	5509195 79d1eeddcf431005d50ac69172143e08a7987c40	no	8
Warnings:					
Information:					
		Total Files Size (in bytes):	7715708		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/21 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission	58

Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

ENCLOSURES (*Check all that apply*)

- [ ] Fee Transmittal Form
- [ ] Fee Attached
- [ ] Amendment/Reply
- [ ] After Final
- [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [x] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
- [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

PTO/SB08 (2 pages)
One Copy of Cited Reference BA and CA (52 pages)

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	MARJAMA MULDOON BLASIAK & SULLIVAN LLP		
Signature	/George S. Blasiak/		
Printed name	George S. Blasiak		
Date	March 18, 2011	Reg. No.	37,283

Transmittal

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: March 18, 2011 Electronic Signature for Nicole R. Pruett: /Nicole R. Pruett/

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017	3751

93689 7590 12/30/2010

HONEYWELL/MARJAMA
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

EXAMINER	
FRECH, KARL D	
ART UNIT	**PAPER NUMBER**
2887	

NOTIFICATION DATE	DELIVERY MODE
12/30/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentservices-us@honeywell.com
ip@cny-iplaw.com
mark.meagher@honeywell.com

TransCore LP
Exhibit 1023 (Page 364)

Office Action Summary	Application No.	Applicant(s)	
	12/567,158	WANG ET AL.	
	Examiner	Art Unit	
	Karl D. Frech	2887	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *9/25/09* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

TransCore LP
Exhibit 1023 (Page 365)

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeakley et al 2007/0152058. Yeakley discloses in paragraph [0043], a host computer 100, including control circuitry provided on a microprocessor inclucing a memory 142, a user interface, an output interface. There is disclosed a Bluetooth radio transceiver device, and an USB (bus).

5. In paragraph [0044], there is disclosed a hand held data collection terminal 10 including control circuitry provided on a microprocessor and appropriate memory. There is disclosed user input interface and user output interface. There is disclosed an encoded information reader device 12 which may be a bar code reader 14, RFID reader 16 or card reader 18. There is disclosed a Bluetooth transceiver 64 and an USB (bus).

6. Yeakley does not specifically disclose that the communication between the host and the data collection terminal is encrypted. Official Notice is taken that Bluetooth communications are typically encrypted. It would have been obvious to a person of ordinary skill in the art at the time of the invention to use encrypted Bluetooth signals in Yeakley to ensure against interference from stray signals from other sources.

7. Yeakley does not specifically disclose the analog to digital conversion. Official Notice is also taken that A/D conversion is typical and old and well known in bar code readers. It would have been obvious to a person of ordinary skill in the art at the time of the invention to convert the analog signal from the read bar code to a digital signal (for the Bluetooth communicaitons) to provide a more accurate and efficient transmission.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karl D. Frech whose **email address is** karl.frech@uspto.gov. If attempts to reach the examiner by **EMAIL** are unsuccessful, the examiner's telephone number is (571) 272-2390. The examiner can normally be reached on maxi-flex.

IFF ALL attempts to reach the examiner by **EMAIL** and telephone are unsuccessful, the examiner's supervisor, Steven Paik can be reached on (571) 272-

2404. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Karl D Frech/
Primary Examiner, Art Unit 2887

***
8.

Notice of References Cited	Application/Control No. 12/567,158	Applicant(s)/Patent Under Reexamination WANG ET AL.	
	Examiner Karl D. Frech	Art Unit 2887	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2007/0152058	07-2007	Yeakley et al.	235/462.01
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
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	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

TransCore LP
Exhibit 1023 (Page 369)

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BIB DATA SHEET

CONFIRMATION NO. 3751

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/567,158	09/25/2009 RULE	235	2887	H0022017

APPLICANTS

Ynjiun P. Wang, Cupertino, CA;
Huyu Qu, San Jose, CA;
James T. Sauerwein, Charlotte, NC;

** **CONTINUING DATA** **********

** **FOREIGN APPLICATIONS** **********

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
09/30/2009

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
❑ Yes ☑ No	❑ Yes ☑ No	/KARL D FRECH/ Examiner's Signature	❑ Initials	CA	9	26	5

ADDRESS

HONEYWELL/MARJAMA
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962
UNITED STATES

TITLE

ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

FILING FEE RECEIVED		
1842	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	❑ All Fees ❑ 1.16 Fees (Filing) ❑ 1.17 Fees (Processing Ext. of time) ❑ 1.18 Fees (Issue) ❑ Other _____ ❑ Credit

BIB (Rev. 05/07).

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
12567158	12/567,158	WANG ET AL.	
	Examiner	Art Unit	
	Karl D. Frech	2887	

SEARCHED			
Class	Subclass	Date	Examiner
235	462.44 462.45 472.01 472.02 472.03	12/21/2010	KDF
235	462.46	12/21/2010	KDF

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
brs search history attached	12/21/2010	KDF

U.S. Patent and Trademark Office

Part of Paper No. 20101222

Index of Claims	Application/Control No.	Applicant(s)/Patent under Reexamination	
12567158	12/567,158	WANG ET AL.	
	Examiner	**Art Unit**	
	Karl D. Frech	2887	

√	**Rejected**	–	**(Through numeral) Cancelled**	**N**	**Non-Elected**	**A**	**Appeal**
=	**Allowed**	÷	**Restricted**	**I**	**Interference**	**O**	**Objected**

Claim		Date								
Final	Original	12/21/10								
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Exhibit 1023 (Page 372)

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	33131	"bar code reader"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:19
L2	293958	microprocessor same memory	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:19
L3	889306	wireless rfid	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:22
L4	3100	1 and 2 and 3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:22
L5	61737	encrypt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:22
L6	33018	encrypt?	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:22
L7	115	4 and 6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:23

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Exhibit 1023 (Page 373)

L8	100	7 and bus	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/21 21:23

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Exhibit 1023 (Page 374)

PTO/SB/08a (07-09)
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Ynjiun P. Wang
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-5,579,341	11-26-1996	Smith et al.	
	AB*	US-5,812,605	09-22-1998	Smith et al.	
	AC*	US-5,903,825	05-11-1999	Goode et al.	
	AD*	US-6,167,099	12-26-2000	Rader et al.	
	AE*	US-20020055368	05-09-2002	Lee	
	AF*	US-6,751,470	06-15-2004	Ella et al.	
	AG*	US-20050271133	12-08-2005	Waxman	
	AH*	US-20060128332	06-15-2006	van Rooyen et al.	
	AI*	US-20060135084	06-22-2006	Lee	
	AJ*	US-20060279446	12-14-2006	Wang et al.	
	AK*	US-7,190,728	03-13-2007	Kawada et al.	
	AL*	US-7,218,678	05-15-2007	Katta et al.	
	AM*	US-7,283,094	10-16-2007	Lee	
	AN*	US-20080107213	05-08-2008	Gupta et al.	
	AO*	US-20080297404	12-04-2008	Lin et al.	
	AP*	US-20090024550	01-22-2009	Wynn et al.	
	AQ*	US-20090028082	01-29-2009	Wynn et al.	
	AR*	US-20090067388	03-12-2009	van Rooyen et al.	
	AS*	US-20090074106	03-19-2009	See et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	/Karl Frech/	Date Considered	12/21/2010

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

IDS (Citation) by Applicant (21 References)

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 25, 2009 Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KF/

PTO/SB/08a (07-09)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 3

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Ynjiun P. Wang
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AT*	US-20090115549	05-07-2009	Lee	
	AU*	US-20090180403	07-16-2009	Tudosoiu	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	/Karl Frech/	Date Considered	12/21/2010

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. * CITE NO.: Those application(s) which are marked with an single asterisk (*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KF/

PTO/SB/08b (07-09)
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 3 of 3

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Ynjiun P. Wang
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	H0022017

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]

Examiner Signature	/Karl Frech/	Date Considered	12/21/2010

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /KF/

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission	6

Application Number	12/567,158-Conf. #3751
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Art Unit	2887
Examiner Name	K. D. Frech
Attorney Docket Number	H0022017

ENCLOSURES (*Check all that apply*)

- [ ] Fee Transmittal Form
- [ ] Fee Attached
- [ ] Amendment/Reply
- [ ] After Final
- [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
- [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

Supplemental Application Data Sheet with Certificate of Electronic Filing (5 pgs.)

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	MARJAMA MULDOON BLASIAK & SULLIVAN LLP		
Signature	/George S. Blasiak/		
Printed name	George S. Blasiak		
Date	September 16, 2010	Reg. No.	37,283

Transmittal

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 16, 2010 Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

Electronic Acknowledgement Receipt	
EFS ID:	8430491
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	93689
Filer:	George S. Blasiak/Barbara Saltsman
Filer Authorized By:	George S. Blasiak
Attorney Docket Number:	H0022017
Receipt Date:	16-SEP-2010
Filing Date:	25-SEP-2009
Time Stamp:	11:51:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	283_687_-_Application_Data_Sheet_ADS_-_09_16_10.pdf	23916 2d2803e01f8eb0a25cfdd3d743e9ad8d1605dd38	no	5
Warnings:					
Information:					

This is not an USPTO supplied ADS fillable form					
2	Miscellaneous Incoming Letter	283_687_-_Transmittal_PTO_SB-21_-_09_16_10.pdf	29534 3e3b8b8ae6f5ef1c87f1c88fb8437fd48f98b451	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	53450	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Supplemental Application Data Sheet

Application Information

Application number::	12/567,158
Filing Date::	09/25/09
Application Type::	Regular
Subject Matter::	Utility
Suggested classification::	235/462.250
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Number of CD disks::	
Number of copies of CDs::	
Sequence submission?::	None
Computer Readable Form (CRF)?::	No
Number of copies of CRF::	
Title::	Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface
Attorney Docket Number::	H0022017
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	1
Total Drawing Sheets::	9
Small Entity?::	No
Petition included?::	No
Petition Type::	

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Exhibit 1023 (Page 381)

Secrecy Order in Parent Appl.?::	No

Applicant Information

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	Ynjiun
Middle Name::	P.
Family Name::	Wang
City of Residence::	Cupertino
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	10127 Linda Ann Place
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Canada
Status::	Full Capacity
Given Name::	Huyu
Family Name::	Qu
City of Residence::	San Jose
State or Province of Residence::	CA
Country of Residence::	US

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Exhibit 1023 (Page 382)

Street of mailing address::	1642 Briarpoint Drive
City of mailing address::	San Jose
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95131

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	James
Middle Name::	T.
Family Name::	Sauerwein
Name Suffix::	~~Jr.~~
City of Residence::	Charlotte
State or Province of Residence::	NC
Country of Residence::	US
Street of mailing address::	3215 Bon-Rea Drive
City of mailing address::	Charlotte
State or Province of mailing address::	NC
Postal or Zip Code of mailing address::	28226

Correspondence Information

Correspondence Customer Number::	93689

Representative Information

Representative Customer Number::	93689

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Exhibit 1023 (Page 383)

Domestic Priority Information

Foreign Priority Information

Assignee Information

Hand Held Products, Inc.

700 Visions Drive

Skaneateles Falls, NY 13153

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.			
Signature	/George S. Blasiak/	Date	September 16, 2010
Name (Print/Type)	George S. Blasiak	Registration No. (Attorney/Agent)	37,283

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Exhibit 1023 (Page 384)

Application No. (if known): 12/567,158 Attorney Docket No.: H0022017

Certificate of Electronic Filing Under 37 CFR 1.8

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 CFR 1.6(a)(4):

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on September 16, 2010 .
Date

/Barbara A. Saltsman/
Signature

Barbara A. Saltsman
Typed or printed name of person signing Certificate

Registration Number, if applicable

(315) 425-9000
Telephone Number

Note: Each paper must have its own certificate of mailing.

Application Data Sheet (4 pages)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/567,158	09/25/2009	Ynjiun P. Wang	H0022017

CONFIRMATION NO. 3751

93689
HONEYWELL/MARJAMA
Patent Services
101 Columbia Road
P.O.Box 2245
Morristown, NJ 07962

POA ACCEPTANCE LETTER

OC000000040451292

Date Mailed: 03/08/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/26/2010.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/ttkim/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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PTO/SB/80 (01-06)
Approved for use through 12/31/2008. OMB 0651-0035
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 93689

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 93689

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

Hand Held Products, Inc.
700 Visions Drive POB 208
Skaneateles Falls, NY 13153

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	James A. Cairns	Date	Feb 21, 2010
Name	James A. Cairns	Telephone	315-554-6606
Title	Director Intellectual Property - HSM		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	7097763
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	00128
Filer:	Glenn Alan Cavanaugh/mark meagher
Filer Authorized By:	Glenn Alan Cavanaugh
Attorney Docket Number:	H0022017
Receipt Date:	26-FEB-2010
Filing Date:	25-SEP-2009
Time Stamp:	14:41:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73(b).	12-567158_373b.pdf	253534 59fb7a7017595ee508b27942d1dd3012c178cd9c	no	1
Warnings:					
Information:					

2	Power of Attorney	93689_POA.pdf	292671 31a8ae7febddd9f0aec287d1a8f53a394ba648e1	no	1

Warnings:	
Information:	
Total Files Size (in bytes):	546205

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/96 (10-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Hand Held Products, Inc.

Application No./Patent No.: 12/567158 Filed/Issue Date: 09/25/2009

Entitled: ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Hand Held Products, Inc. (Name of Assignee), a Corporation (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☑ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title and interest (The extent (by percentage) of its ownership interest is _____ %)

in the patent application/patent identified above by virtue of either:

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 023285, Frame 0492, or for which a copy therefore is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____
   The document was recorded in the United States Patent and Trademark Office at
   Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
   The document was recorded in the United States Patent and Trademark Office at
   Reel _____, Frame _____, or for which a copy thereof is attached.
3. From: _____ To: _____
   The document was recorded in the United States Patent and Trademark Office at
   Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☑ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature	Date: 3-22-2010
James A. Cairns	315-554-6606
Printed or Typed Name	Telephone Number
Director Intellectual Property - HSM	
Title	

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
12/567,158	09/25/2009	2617	1842	H0022017	26	5

CONFIRMATION NO. 3751

128
HONEYWELL INTERNATIONAL INC.
PATENT SERVICES
101 COLUMBIA ROAD
P O BOX 2245
MORRISTOWN, NJ 07962-2245

FILING RECEIPT



Date Mailed: 10/05/2009

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Ynjiun P. Wang, Cupertino, CA;
Huyu Qu, San Jose, CA;
James T. Sauerwein, Charlotte, NC;

Assignment For Published Patent Application

Hand Held Products, Inc., Skaneateles Falls, NY

Power of Attorney: None

Domestic Priority data as claimed by applicant

Foreign Applications

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 09/30/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/567,158**

Projected Publication Date: 03/31/2011

Non-Publication Request: No

Early Publication Request: No

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Exhibit 1023 (Page 391)

Title

ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

Preliminary Class

455

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where

TransCore LP
Exhibit 1023 (Page 392)

the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

TransCore LP
Exhibit 1023 (Page 393)

PTO/SB/05 (08-08)
Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(ONLY FOR NEW NONPROVISIONAL APPLICATIONS UNDER 37 CFR 1.53(B))

Attorney Docket No.	H0022017
First Inventor	Ynjiun P. Wang
Title	Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [X] **Fee Transmittal Form** (e.g., PTO/SB/17)
2. [ ] **Applicant claims small entity status.** See 37 CFR 1.27.
3. [X] **Specification** [*Total Pages* 35]
   Both the claims and abstract must start on a new page
   (For information on the preferred arrangement, see MPEP 608.01(a))
4. [X] **Drawing(s)** *(35 U.S.C. 113)* [*Total Sheets* 9]
5. **Oath or Declaration** [*Total Sheets* 5]
   a. [X] Newly executed (original or copy)
   b. [ ] A copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 18 completed)
   i. [ ] DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. [X] **Application Data Sheet.** See 37 CFR 1.76
7. [ ] **CD-ROM or CD-R** in duplicate, large table or Computer Program *(Appendix)*
   [ ] Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission** *(if applicable, items a. – c. are required)*
   a. [ ] Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
   i. [ ] CD-ROM or CD-R (2 copies); or ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO: **Commissioner for Patents**
P.O. Box 1450
Alexandria, VA 22313-1450

ACCOMPANYING APPLICATION PARTS

9. [ ] **Assignment Papers** (cover sheet & document(s))
   Name of Assignee
10. [ ] **37 CFR 3.73(b) Statement** *(when there is an assignee)* [X] **Power of Attorney**
11. [ ] **English Translation Document** *(if applicable)*
12. [X] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
13. [ ] **Preliminary Amendment**
14. [ ] **Return Receipt Postcard** (MPEP 503) *(Should be specifically itemized)*
15. [ ] **Certified Copy of Priority Document(s)** *(if foreign priority is claimed)*
16. [ ] **Nonpublication Request** under 35 U.S.C.122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. [X] Other: PTO/39 (1 pg.)

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*
[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No.: .....
Prior application information: Examiner _____ *Art Unit:* _____

19. CORRESPONDENCE ADDRESS

[X] The address associated with Customer Number: 00128 ***OR*** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/George S. Blasiak/	Date	September 25, 2009
Name (Print/Type)	George S. Blasiak	Registration No. (Attorney/Agent)	37,283

Utility Patent Application Transmittal

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 25, 2009 Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

PTO/SB/17 (10-08)
Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no person are required to respond to a collection of information unless it displays a valid OMB control number

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2009

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 1,842.00

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Examiner Name	Not Yet Assigned
Art Unit	N/A
Attorney Docket No.	H0022017

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 50-0289 Deposit Account Name: Marjama Muldoon Blasiak & Sullivan LLP

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fees Paid ($)**
Utility	330	165	540	270	220	110	1,090.00
Design	220	110	100	50	140	70	
Plant	220	110	330	165	170	85	
Reissue	330	165	540	270	650	325	
Provisional	220	110	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	**Fee ($)**	**Small Entity Fee ($)**
Each claim over 20 (including Reissues)	52	26
Each independent claim over 3 (including Reissues)	220	110
Multiple dependent claims	390	195

Total Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
26	- 20 or HP	6	x 52.00	=	312.00

HP = highest number of total claims paid for, if greater than 20.

Multiple Dependent Claims

Fee ($)	**Fee Paid ($)**

Indep. Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
5	- 3 or HP =	2	x 220.00	=	440.00

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		**Extra Sheets**		**Number of each additional 50 or fraction thereof**	**Fee ($)**	**Fee Paid ($)**
44	- 100 =		/50 =	(round **up** to a whole number) x		=

4. OTHER FEE(S) **Fees Paid ($)**

Non-English Specification, $130 fee (no small entity discount)

Other (e.g., late filing surcharge): _____

SUBMITTED BY

Signature	/George S. Blasiak/	Registration No. (Attorney/Agent)	37,283	Telephone	(315) 425-9000
Name (Print/Type)	George S. Blasiak			Date	September 25, 2009

Fee Transmittal

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 25, 2009 Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

Application Data Sheet

Application Information

Application Type::	Regular
Subject Matter::	Utility
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Number of CD disks::	
Number of copies of CDs::	
Sequence submission?::	None
Computer Readable Form (CRF)?::	No
Number of copies of CRF::	
Title::	Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface
Attorney Docket Number::	H0022017
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	1
Total Drawing Sheets::	9
Small Entity?::	No
Petition included?::	No
Petition Type::	
Secrecy Order in Parent Appl.?::	No

Applicant Information

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	Ynjiun
Middle Name::	P.
Family Name::	Wang

TransCore LP
Exhibit 1023 (Page 396)

City of Residence::	Cupertino
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	10127 Linda Ann Place
City of mailing address::	Cupertino
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95014

Applicant Authority Type::	Inventor
Primary Citizenship Country::	Canada
Status::	Full Capacity
Given Name::	Huyu
Family Name::	Qu
City of Residence::	San Jose
State or Province of Residence::	CA
Country of Residence::	US
Street of mailing address::	1642 Briarpoint Drive
City of mailing address::	San Jose
State or Province of mailing address::	CA
Postal or Zip Code of mailing address::	95131

Applicant Authority Type::	Inventor
Primary Citizenship Country::	US
Status::	Full Capacity
Given Name::	James
Middle Name::	T.
Family Name::	Sauerwein
Name Suffix::	Jr.
City of Residence::	Charlotte
State or Province of Residence::	NC
Country of Residence::	US
Street of mailing address::	3215 Bon-Rea Drive

Initial 09/25/09

City of mailing address::	Charlotte
State or Province of mailing address::	NC
Postal or Zip Code of mailing address::	28226

Correspondence Information

Correspondence Customer Number::	00128

Representative Information

Representative Customer Number::	20874

Domestic Priority Information

Foreign Priority Information

Assignee Information: Hand Held Products, Inc.
700 Visions Drive
Skaneateles Falls, NY 13153

Initial 09/25/09

TransCore LP
Exhibit 1023 (Page 398)

Application No. (if known): Attorney Docket No.: H0022017

Certificate of Electronic Filing Under 37 CFR 1.8

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with 37 CFR 1.6(a)(4):

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on September 25, 2009 .
Date

/Barbara A. Saltsman/
Signature

Barbara A. Saltsman
Typed or printed name of person signing Certificate

Registration Number, if applicable

(315) 425-9000
Telephone Number

Note: Each paper must have its own certificate of mailing.

Application Data Sheet (3 pages)

PTO/SB/05 (08-08)
Approved for use through 06/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(ONLY FOR NEW NONPROVISIONAL APPLICATIONS UNDER 37 CFR 1.53(B))

Attorney Docket No.	H0022017
First Inventor	Ynjiun P. Wang
Title	Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [X] **Fee Transmittal Form** (e.g., PTO/SB/17)
2. [ ] **Applicant claims small entity status.** See 37 CFR 1.27.
3. [X] **Specification** [*Total Pages* 35]
   Both the claims and abstract must start on a new page
   (For information on the preferred arrangement, see MPEP 608.01(a))
4. [X] **Drawing(s)** *(35 U.S.C. 113)* [*Total Sheets* 9]
5. **Oath or Declaration** [*Total Sheets* 5]
   a. [X] Newly executed (original or copy)
   b. [ ] A copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 18 completed)
   i. [ ] DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. [X] **Application Data Sheet.** See 37 CFR 1.76
7. [ ] **CD-ROM or CD-R** in duplicate, large table or Computer Program *(Appendix)*
   [ ] Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission** *(if applicable, items a. – c. are required)*
   a. [ ] Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
   i. [ ] CD-ROM or CD-R (2 copies); or ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO: **Commissioner for Patents**
P.O. Box 1450
Alexandria, VA 22313-1450

ACCOMPANYING APPLICATION PARTS

9. [ ] **Assignment Papers** (cover sheet & document(s))
   Name of Assignee
10. [ ] **37 CFR 3.73(b) Statement** *(when there is an assignee)* [X] **Power of Attorney**
11. [ ] **English Translation Document** *(if applicable)*
12. [X] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
13. [ ] **Preliminary Amendment**
14. [ ] **Return Receipt Postcard** (MPEP 503) *(Should be specifically itemized)*
15. [ ] **Certified Copy of Priority Document(s)** *(if foreign priority is claimed)*
16. [ ] **Nonpublication Request** under 35 U.S.C.122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. [X] Other: PTO/39 (1 pg.)

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*
[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No.: .....
Prior application information: Examiner _____ *Art Unit:* _____

19. CORRESPONDENCE ADDRESS

[X] The address associated with Customer Number: 00128 ***OR*** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	/George S. Blasiak/	Date	September 25, 2009
Name (Print/Type)	George S. Blasiak	Registration No. (Attorney/Agent)	37,283

Utility Patent Application Transmittal

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 25, 2009 Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

PTO/SB/17 (10-08)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2009

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 1,842.00

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	September 25, 2009
First Named Inventor	Ynjiun P. Wang
Examiner Name	Not Yet Assigned
Art Unit	N/A
Attorney Docket No.	H0022017

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

☒ Deposit Account Deposit Account Number: 50-0289 Deposit Account Name: Marjama Muldoon Blasiak & Sullivan LLP

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fees Paid ($)**
Utility	330	165	540	270	220	110	1,090.00
Design	220	110	100	50	140	70	
Plant	220	110	330	165	170	85	
Reissue	330	165	540	270	650	325	
Provisional	220	110	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	**Fee ($)**	**Small Entity Fee ($)**
Each claim over 20 (including Reissues)	52	26
Each independent claim over 3 (including Reissues)	220	110
Multiple dependent claims	390	195

Total Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
26	- 20 or HP	6	x 52.00	=	312.00

HP = highest number of total claims paid for, if greater than 20.

Multiple Dependent Claims — **Fee ($)** _____ **Fee Paid ($)** _____

Indep. Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
5	- 3 or HP =	2	x 220.00	=	440.00

HP = highest number of independent claims paid for, if greater than 3.

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		**Extra Sheets**		**Number of each additional 50 or fraction thereof**		**Fee ($)**		**Fee Paid ($)**
44	- 100 =	_____	/50 =	_____	(round **up** to a whole number) x	_____	=	_____

4. OTHER FEE(S) **Fees Paid ($)**

Non-English Specification, $130 fee (no small entity discount)

Other (e.g., late filing surcharge): _____

SUBMITTED BY

Signature	/George S. Blasiak/	Registration No. (Attorney/Agent)	37,283	Telephone	(315) 425-9000
Name (Print/Type)	George S. Blasiak			Date	September 25, 2009

Fee Transmittal

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 25, 2009 Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

Doc Code: PD.TO.AUTH
Document Description: Authorization to access Appl. By Trilateral Office

PTO/SB/39 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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AUTHORIZATION TO PERMIT ACCESS TO APPLICATION BY PARTICIPATING OFFICES

Send completed form to: Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

COMPLETE IF KNOWN	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Ynjiun P. Wang
Attorney Docket Number	H0022017
Title (Required)	Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface

The undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h).

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 USC 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This written authorization should be submitted prior to the filing of a subsequent foreign application, in which priority is claimed to the above-identified patent application, with any intellectual property office (e.g., the EPO, JPO, KIPO, or DAS Accessing Office). However, if applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application, this written authorization should not be filed.

No fee will be charged under 37 CFR 1.19(b)(1)for providing a participating intellectual property office with an electronic copy of the above-identified application.

This form must be signed by an authorized party in accordance with 37 CFR 1.14(c).

/George S. Blasiak/	September 25, 2009
Signature	Date
George S. Blasiak	(315) 425-9000
Printed or Typed Name	Telephone Number
Attorney for Applicant(s)	37,283
Title	Registration Number, if applicable

Authorization to Permit Access to Application

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4).

Dated: September 25, 2009 Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

TransCore LP
Exhibit 1023 (Page 402)

Honeywell Docket No. H0022017

DECLARATION FOR PATENT APPLICATION

For use with Application Data Sheet

Title of Invention: **Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface**

As the below named inventor(s), I/we declare that:

This declaration is directed to:
_X_ the attached application, or
___ Application No. _____ filed on _____
___ as amended on _____(if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Please direct all correspondence: to the address associated with Customer Number 00128.

Please direct telephone calls: primarily to George S. Blasiak at 315-425-9000.

AUTHORIZATION TO PERMIT ACCESS TO APPLICATION BY PARTICIPATING OFFICES

☒ If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified application is filed access to the above-identified patent application.

All statements made herein of my/our own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

Signature of Sole or First Inventor: _____ Date: 9/21/2009

Full Name of Sole or First Inventor: Ynjiun P. Wang

Residence City: Cupertino Residence State: California

Residence Country: United States Citizenship: United States

Business Mailing Address: Honeywell International Inc., Patent Services M\S AB\2B, P.O. Box 2245
Morristown, NJ, 07962-2245

Honeywell Docket No. H0022017

DECLARATION FOR PATENT APPLICATION

For use with Application Data Sheet

Title of Invention: **Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface**

As the below named inventor(s), I/we declare that:

This declaration is directed to:
_X_ the attached application, or
____ Application No. _____ filed on _____
___ as amended on _____(if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

Please direct all correspondence: to the address associated with Customer Number **00128.**

Please direct telephone calls: primarily to George S. Blasiak at 315-425-9000.

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All statements made herein of my/our own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

Signature of Sole or First Inventor: _____ Date: _____

Full Name of Sole or First Inventor: **Ynjiun P. Wang**

Residence City: Cupertino Residence State: California

Residence Country: United States Citizenship: United States

Business Mailing Address: Honeywell International Inc., Patent Services M\S AB\2B, P.O. Box 2245
Morristown, NJ, 07962-2245

Honeywell Docket No. H0022017

DECLARATION FOR PATENT APPLICATION

For use with Application Data Sheet

Signature of Sole or Second Inventor: Huyu Qu Date: 9/21/2009

Full Name of Sole or Second Inventor: Huyu Qu

Residence City: San Jose Residence State: California

Residence Country: United States Citizenship: Canada

Business Mailing Address: Honeywell International Inc., Patent Services M\S AB\2B, P.O. Box 2245
Morristown, NJ, 07962-2245

Honeywell Docket No. H0022017

DECLARATION FOR PATENT APPLICATION

For use with Application Data Sheet

Title of Invention: **Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface**

As the below named inventor(s), I/we declare that:

This declaration is directed to:
_X_ the attached application, or
____ Application No. _____ filed on _____
___ as amended on _____(if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

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Signature of Sole or First Inventor: _____ Date: _____

Full Name of Sole or First Inventor: **Ynjiun P. Wang**

Residence City: Cupertino Residence State: California

Residence Country: United States Citizenship: United States

Business Mailing Address: Honeywell International Inc., Patent Services M\S AB\2B, P.O. Box 2245
Morristown, NJ, 07962-2245

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Signature of Sole or Third Inventor: _____ Date: 09-24-09

Full Name of Sole or Third Inventor: **James T. Sauerwein**

Residence City: Charlotte Residence State: North Carolina

Residence Country: United States Citizenship: United States

Business Mailing Address: Honeywell International Inc., Patent Services M\S AB\2B, P.O. Box 2245
Morristown, NJ, 07962-2245

ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE

FIELD OF THE INVENTION

[0001] The invention is generally related to encoded information reading (EIR) terminals and is specifically related to an EIR terminal comprising a multi-protocol wireless communication interface.

BACKGROUND OF THE INVENTION

[0002] Encoded information reading (EIR) terminals equipped with wireless communication interfaces are widely used in retail stores, shipping facilities, etc. While wireless communication of EIR terminals offers many advantages as compared to wired communications, traditional wireless communication interfaces have noticeable shortcomings, *e.g.*, by failing to support more than one communication protocol and/or standard.

[0003] Accordingly, there is a need for further advances in EIR terminals and systems which would support multiple communication protocols and standards.

SUMMARY OF THE INVENTION

[0004] In one embodiment, there is provided an encoded information reading (EIR) terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0005] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0006] The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter

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(ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0007] The microprocessor can be configured to execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream.

[0008] The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0009] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0010] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0011] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

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[0012] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0013] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface.

[0014] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0015] The wireless communication interface can comprise an RF front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The RF front can be end electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus.

[0016] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

[0017] In another embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0018] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

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[0019] The EIR terminal can be configured to execute a wireless communication protocol selector software program, which can optimize a value of a user-defined criterion in order to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol.

[0020] In a further embodiment, there is provided an encoded information reading terminal comprising a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface configured to support at least two wireless communication protocols.

[0021] The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message.

[0022] The EIR terminal can be configured to dynamically select a wireless communication network, a wireless communication protocol, and/or a parameter of a wireless communication protocol responsive a user action and/or to scanning a pre-defined bar code.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] For the purpose of illustrating the invention, the drawings show aspects of one or more embodiments of the invention. However, it should be understood that the present invention is not limited to the precise arrangements and instrumentalities shown in the drawings, wherein:

[0024] Fig. 1 depicts a network level layout of a data collection system employing EIR terminal according to the invention;

[0025] Fig. 2 depicts a functional layout of a wireless communication interface;

[0026] Fig. 3 depicts a component level layout of an EIR terminal according to the invention;

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[0027] Fig. 4 illustrates the functions of the base-band encoder software program according to the invention;

[0028] Fig. 5 illustrates the functions of the base-band encoder software program according to the invention;

[0029] Figs. 6a and 6b illustrate an exemplary hand held EIR terminal housing;

[0030] Figs. 7a-7c illustrate an exemplary portable and remountable EIR terminal housing;

[0031] Fig. 8a illustrates a first exemplary deployment of an EIR terminal according to the invention within a retail store;

[0032] Fig. 8b illustrates a second exemplary deployment of an EIR terminal according to the invention within a retail store;

[0033] Figs. 8c and 8d illustrate PIN and signature data entry operational modes of an EIR terminal according to the invention.

[0034] The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the drawings, like numerals are used to indicate like parts throughout the various views.

DETAILED DESCRIPTION OF THE INVENTION

[0035] There is provided an encoded information reading (EIR) terminal for incorporation in a data collection system. The data collection system, schematically shown in Fig. 1, can include a plurality of EIR terminals 100a-100z in communication with a plurality of interconnected networks 110a-110z. In one aspect, the plurality of networks 110a-110z can include at least one IEEE 802.11 conformant wireless network. In another aspect, an EIR terminal 100a can be in communication with at least one wireless device over Bluetooth ™ wireless communication protocol. In a further aspect, the plurality of networks 110a-110z can include at least one GSM wireless network. In a further aspect, the plurality of networks 110a-110z can include at least one CDMA wireless network. Still further, the plurality of networks 110a-110z can include at least one 3G wireless network, *e.g.,* UMTS,

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HSUPA/HSDPA, or CDMA2000EvDO. In another aspect, the plurality of networks 110a-110z can include at least one 4G wireless network, *e.g.,* LTE, UWB, or 802.16m (WiMax). A skilled artisan would appreciate the fact that wireless networks implementing other wireless communication protocols are within the spirit and the scope of the invention.

[0036] In one aspect, an EIR terminal can comprise a wireless communication interface. The EIR terminal 100c can establish a communication session with the host computer 171. In one embodiment, network frames can be exchanged by the EIR terminal 100c and the host computer 171 via one or more routers, base stations, and other infrastructure elements. In another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a local area network (LAN). In a yet another embodiment, the host computer 171 can be reachable by the EIR terminal 100c via a wide area network (WAN). A skilled artisan would appreciate the fact that other methods of providing interconnectivity between the EIR terminal 100c and the host computer 171 relying upon LANs, WANs, virtual private networks (VPNs), and/or other types of network are within the spirit and the scope of the invention.

[0037] In a further aspect, the wireless communication interface can be configured to support at least two wireless communication protocols. In one embodiment, the wireless communication interface can be configured to support HSPA/GSM/GPRS/EDGE protocol family and CDMA/EV-DO protocol family. A skilled artisan would appreciate the fact that wireless communication interfaces supporting other communication protocols are within the spirit and the scope of the invention.

[0038] In one embodiment, the communications between the EIR terminal 100c and the host computer 171 can comprise a series of HTTP requests and responses transmitted over one or more TCP connections, although a person skilled in the art would appreciate the fact that using other transport and application level protocols is within the scope and the spirit of the invention.

[0039] In one aspect, at least one of the messages transmitted by the EIR terminal can include decoded message data corresponding to, *e.g.*, a bar code label or an RFID label attached to a product or to a shipment item. For example, an EIR terminal can transmit a request to the host computer to retrieve product information corresponding to a product

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identifier encoded by a bar code label attached to the product, or to transmit an item tracking record for an item identified by a bar code label attached to the product.

[0040] A wireless communication interface 210 best viewed in Fig. 2, can comprise a transmitter circuit 220 electrically coupled to a data source 221. The transmitter circuit 220 can be implemented by one or more specialized microchips, and can perform the following functions: source encoding 223, encryption 226, channel encoding 229, multiplexing 232, modulation 235, and frequency spreading 238.

[0041] The wireless communication interface 210 of Fig. 2 can further comprise a receiver circuit 250 electrically coupled to the data sink 271. The receiver circuit 250 can be implemented by one or more specialized microchips, and can perform the following functions: frequency de-spreading 253, demodulation 256, de-multiplexing 259, channel decoding 262, decryption 265, and source decoding 268.

[0042] Each of the transmitter circuit 220 and receiver circuit 250 can be electrically coupled to a radio frequency (RF) front end 299. The RF front end 299 can be used to convert high frequency RF signals to/from base-band or intermediate frequency signals. A skilled artisan would appreciate the fact that RF front ends of different data rates, sensitivities, output powers, operating frequencies, and measurement resolutions are within the scope and spirit of the invention.

[0043] On the receiving side, the RF front-end 299 can include all filters, low-noise amplifiers (LNAs), and down-conversion mixer(s) needed to process modulated RF signals received by the antenna into based-band signals. In one embodiment, the receiving part of the RF front end 299 can comprise one or more of the following components:

- a first matching circuit to transfer to the next stage the energy received by the antenna;
- a band-pass filter (BPF) to knock down out-of-band jammers;
- a second matching circuit at the input of a low-noise amplifier (LNA);
- the LNA, the primary responsibility of which is to set the sensitivity of the receiver, by providing a high gain;

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- a third matching circuit between the LNA output and the receive (RX) mixer (down-converter);

- the down-conversion RX mixer.

[0044] On the transmitting side, the RF frond-end area can be described as a "mirrored" version of a receiver. The front end of a transmitter up converts an outgoing base-band signal and then feeds the signal to a high power amplifier. A skilled artisan would appreciate the fact that other ways of implementing the RF front end are within the spirit and the scope of the invention.

[0045] According to one embodiment of the invention, the wireless communication interface supporting at least two wireless communication protocols can be implemented using a single dual-protocol (or multi-protocol) chipset. The chipset can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0046] In another embodiment, the wireless communication interface supporting at least two wireless communication protocols can be implemented using two or more chipsets. Each of the chipsets can include integrated circuits (ICs), application specific integrated circuits (ASICs), and/or other components providing the necessary functionality.

[0047] In a yet another embodiment, at least some of the functions of the transmitter circuit and the receiver circuit can be advantageously performed by one or more software programs executed by a microprocessor. In one embodiment the EIR terminal 100 can comprise at least one microprocessor 310 and a memory 320, both coupled to the system bus 370, as best viewed in Fig. 3.

[0048] The microprocessor 310 can be provided by a general purpose microprocessor or by a specialized microprocessor (*e.g.*, an ASIC). In one embodiment, the EIR terminal 100 can comprise a single microprocessor which can be referred to as a central processing unit (CPU) and which can perform at least some of the functions of the transmitter circuit and the receiver circuit. In another embodiment, the EIR terminal 100 can comprise two or more microprocessors; for example, a CPU providing some or most of the EIR functionality and a specialized microprocessor performing some of the functions of the transmitter circuit and the

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receiver circuit. A skilled artisan would appreciate the fact that different schemes of processing tasks distribution among the two or more microprocessors are within the spirit and the scope of the invention.

[0049] The EIR terminal 100 can further comprise one or more encoded information reading (EIR) devices 330, including a bar code reading device, an RFID reading device, and a card reading device, also coupled to the system bus 370. In one embodiment, an EIR reading device can be capable of outputting decoded message data corresponding to an encoded message. In another embodiment, the EIR reading device can output raw message data containing an encoded message, *e.g.*, raw image data or raw RFID data.

[0050] Of course, devices that read bar codes, read RFID, or read cards bearing encoded information may read more than one of these categories while remaining within the scope of the invention. For example, a device that reads bar codes may include a card reader, and/or RFID reader; a device that reads RFID may also be able to read bar codes and/or cards; and a device that reads cards may be able to also read bar codes and/or RFID. For further clarity, it is not necessary that a device's primary function involve any of these functions in order to be considered such a device; for example, a cellular telephone, smartphone, or PDA that is capable of reading bar codes is a device that reads bar codes for purposes of the present invention

[0051] The EIR terminal 100 can further comprise a keyboard interface 354 and a display adapter 355, both also coupled to the system bus 370. The EIR terminal 100 can further comprise a battery 356.

[0052] In a further aspect, the EIR terminal 100 can further comprise an RF front end 340. In a further aspect, the EIR terminal 100 can further comprise an analog-to-digital (ADC) converter 350, the input of which can be electrically coupled to the RF front end 340. The choice of ADC can be determined by the receiver architecture, and can depend upon the selectivity of the filters, the dynamic range afforded by the front-end amplifiers, and the bandwidth and type of modulation to be processed. For example, the level or dynamic range of signals expected to be presented to the ADC will dictate the bit resolution needed for the converter. An ADC can also be specified in terms of its spurious-free dynamic range (SFDR). The ADC's sensitivity can be influenced by wideband noise, including spurious

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noise, and can be improved through the use of an anti-aliasing filter at the input of the ADC to eliminate sampling of noise and high-frequency spurious products. To avoid aliasing when converting analog signals to the digital domain, the ADC sampling frequency must be at least twice the maximum frequency of the input analog signal. This minimum sampling condition derived from Nyquist's theorem, must be met in order to capture enough information about the input analog waveform to reconstruct it accurately. In addition to selecting an ADC for IF or baseband sampling, the choice of buffer amplifier to feed the input of the converter can affect the performance possible with a given sampling scheme. The buffer amplifier should provide the rise/fall time and transient response to preserve the modulation information of the IF or base-band signals, while also providing the good amplitude accuracy and flatness needed to provide signal amplitudes at an optimum input level to the ADC for sampling.

[0053] In another embodiment, the EIR terminal 100 can further comprise a digital-to-analog (DAC) converter 360, the output of which can be electrically coupled to the RF front end 340. In a further aspect, a DAC can be viewed as a component providing a function reversed to that of an ADC.

[0054] In a further aspect, the output of the ADC 350, and the input of the DAC 360 can be electrically coupled to a system bus 370. A skilled artisan would appreciate the fact that other microprocessors, memory, and/or peripheral devices can be electrically coupled to the system bus 370 without departing from the scope and the spirit of the invention.

[0055] In another aspect, the microprocessor 310 can execute a base-band encoder software program which can encode a bit stream which needs to be transmitted over a wireless medium. The encoded bit stream outputted by the base-band encoder software program can be fed to the input of the DAC 360. The analog signal representative of the encoded bit stream can be outputted by the DAC 360 to the RF front end 340 in order to be transmitted over a wireless medium.

[0056] In one embodiment, the base-band encoder software program 400 can perform at least one of the following functions schematically shown in Fig. 4: source encoding 410 of a bit stream 405, encryption 420, channel encoding 430, multiplexing 440, modulation 450, frequency spreading 460, and media access control 470. In one embodiment, the remaining

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functions (*i.e.,* those not implemented by the base-band encoder software program) can be implemented by one or more dedicated hardware components.

[0057] In one aspect, the source encoding function 410 can be provided by a process of encoding information using a different number of bits (or other information bearing units) than an un-encoded representation would use, through use of specific encoding schemes.

[0058] In another aspect, the encryption function 420 can be implemented by using an algorithm (cipher) suitable to transform an unencrypted ("plain text") information stream to an encrypted information stream.

[0059] In a further aspect, the channel encoding function 430 can be provided by a process suitable to encode the transmitted information stream into a form, which would allow guaranteed reliable information transmission at a rate close to the maximum channel capacity. According to the Shannon theorem, for a given bandwidth and signal-to-noisy ratio, the theoretical maximum channel capacity (reliable information transfer rate) for a particular noise level is defined by the following equation:

$$C = B\log_2(1+\tfrac{S}{N}).$$

[0060] For any information transmission rate R < C, there exists an encoding scheme that would allow the probability of errors at the receiver to be made less than a pre-defined value ε. The channel encoding function 430 can select and/or implement an encoding scheme for a pre-defined value of ε.

[0061] In a further aspect, the multiplexing function 440 can be employed to combine multiple signals or data streams into one signal transmitted over a shared physical transmission medium (wireless channel). The multiplexing function 440 can implement one or more of the multiplexing technologies including TDMA (Time division multiple access), FDMA (Frequency division multiple access), CDMA (Code division multiple access), CSMA (Carrier sense multiple access), etc.

[0062] In a further aspect, the frequency spreading function 460 can implement one or more of the following technologies: DSSS (Direct Sequence Spread Spectrum), FHSS

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(Frequency Hopping Spread Spectrum), and OFDM (Orthogonal Frequency Division Multiplexing).

[0063] In a further aspect, the media access control function 470 can provide addressing and channel access control mechanisms.

[0064] In another aspect, the RF front end 340 can output to the ADC 350 an analog signal representative of a signal received over the wireless medium. The ADC 350 can output a digital signal representative of the analog signal outputted by the RF front end 340. The microprocessor 310 can execute a base-band decoder software program which can input the digital signal outputted by the ADC 350 and can decode the digital signal into a form suitable for further processing by other software programs.

[0065] In a further aspect, the base-band decoder software program 500 can perform at least at least one of the following functions schematically shown in Fig. 5: media access control 510, frequency de-spreading 520, de-modulation 530, de-multiplexing 540 the analog signal, channel decoding 560, decryption 570, and source decoding 580. In one embodiment, the remaining functions (*i.e.*, those not implemented by the base-band decoder software program) can be implemented by one or more dedicated hardware components.

[0066] In one aspect, each of the frequency de-spreading 520, de-modulation 530, de-multiplexing 540, channel decoding 560, decryption 570, and source decoding 580 functions can be implemented as a reverse function of the frequency spreading 460, modulation 450, multiplexing 440, channel encoding 430, encryption 420, source encoding 410 functions, respectively.

[0067] In another aspect, the base-band encoder software program can be implemented as two or more software programs. In another aspect, the base-band decoder software program can be implemented as two or more software programs. In a further aspect, the base-band encoder software program and the base-band decoder software program can be implemented as a single software program.

[0068] In another aspect, due to advantageously performing at least some of the source bit stream encoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following

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functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control.

[0069] In another aspect, due to advantageously performing at least some of the analog signal decoding functions by a software program, the EIR terminal 100 can be devoid of dedicated hardware components configured to implement at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

[0070] In a further aspect, the EIR terminal 100 can be configured to dynamically select a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol (*e.g.*, frequency or transmission power) to be used by the RF front end 340.

[0071] Due to its ability to dynamically select a wireless communication network and a wireless communication protocol, the EIR terminal 100 according to the present invention can be advantageously used, *e.g.*, by a company operating in several geographies with different wireless communication standards. Using the EIR terminal 100 according to the present invention would allow such a company to deploy the same EIR terminal 100 model in all the geographies.

[0072] In one embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of a wireless communication protocol can be performed manually by the user of the EIR terminal 100. In one embodiment, the selection can be performed by scanning a pre-defined bar code. In another embodiment, the selection can be performed by the user interacting with the user interface (*e.g.*, via a graphical user interface (GUI), or via a hardware-implemented control). A skilled artisan would appreciate the fact that other methods of manually selecting a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol are within the scope and the spirit of the invention.

[0073] In another embodiment, selection of a wireless communication network, a wireless communication protocol, or one or more parameters of the wireless communication protocol can be performed by a wireless communication protocol selector software program

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executed by the EIR terminal 100. The wireless communication protocol selector software program can optimize a value of a user-defined criterion.

[0074] In one embodiment, the value of the user-defined criterion can be calculated based on one or more of the following parameters: frequency range, network status, signal strength, service cost, communication channel throughput, and user preferences. The user preferences can be represented, *e.g.*, by network preference, service preference, protocol preference, or frequency preference. A skilled artisan would appreciate the fact that other types of user preferences are within the spirit and the scope of the invention.

[0075] In one embodiment, the value of the user-defined criterion can be calculated as a weighted sum of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). In another embodiment, the value of the user-defined criterion can be calculated as a square root of a weighted sum of squares of components each of which is represented by either a parameter itself *(e.g.*, the signal strength) or a difference between the value of a parameter and the desired value of the parameter *(e.g.*, communication channel throughput). A skilled artisan would appreciate the fact that other methods of calculating the user-defined criterion value are within the scope and spirit of the invention.

[0076] For example, if a user is more concerned about the cost than about other communication parameters, the user would want the user-defined criterion to yield the cheapest covered service provider (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or network selection). In another example, if a user is more concerned about the signal quality than about other communication parameters, the user would want the user-defined criterion to yield the network with best quality (while the cost can be a secondary factor affecting the service provider and/or network selection). In a yet another example, if a user is more concerned about maintaining uninterrupted communication session than about other communication parameters, the user would want the user-defined criterion to yield the network with best connection reliability (while the bandwidth, frequency range, and/or network protocol can possibly be secondary factors affecting the service provider and/or

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network selection). A skilled artisan would appreciate the fact that other methods of defining the user-defined criterion are within the scope and the spirit of the invention.

[0077] In one embodiment, the EIR terminal 100 can be configured to search beacon signals over a pre-defined frequency range (*e.g.*, between 800MHz and 5GHz), and then select a wireless communication network and/or frequency channel which would produce the optimal value of the user-defined criterion.

[0078] In one embodiment, the value of the user-defined criterion can be calculated immediately before the EIR terminal 100 attempts to initiate a communication session, so that a wireless communication network and/or a wireless communication protocol can be chosen which would optimize the user-defined criterion.

[0079] In another embodiment, the value of the user-defined criterion can be calculated periodically at established time intervals so that the EIR terminal 100 can change the wireless communication network and/or the wireless communication protocol between communication sessions or during a communication session if a wireless communication network and/or a wireless communication protocol is detected yielding a value of the user-defined criterion which is closer to the optimum than that of the current network or protocol. In yet another embodiment, the value of a user-defined criterion can be calculated responsive to a pre-defined event (*e.g.*, the signal quality falling below a pre-defined level, or the signal quality exceeding a pre-defined threshold), so that the EIR terminal 100 can automatically (*i.e.*, without user intervention) change the wireless communication network and/or the wireless communication protocol between communication sessions or during a communication session. Thus, the EIR terminal 100 can always maintain a network connection irrespectively of changing external conditions (*e.g.*, when the terminal is physically moved).

[0080] Form factors and housings for the EIR terminal 100 according to the invention are now being described. The components of EIR terminal 100 can be incorporated into a variety of different housings. As indicated by the embodiment of Figs. 6a and 6b, the components of Fig. 5 can be incorporated into a hand held housing 101. EIR terminal 100 of Figs. 6a and 6b is in the form factor of a hand held portable data terminal. EIR terminal 100 as shown in Figs. 6a and 6b includes a keyboard 1090, a display 504 having an associated touch screen

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overlay, a card reader 1348, and an imaging module 360 which includes the components of imaging assembly as described herein; namely, image sensor array incorporated on an image sensor IC chip. Imaging module 360 has an associated imaging axis, a_i. As indicated by the side view of Fig. 6b, the components of the block diagram of Fig. 5 may be supported within housing 101 on a plurality of circuit boards 1077. Imaging module 360 may include an image sensor array having color sensitive pixels as described in U. S. Provisional Patent Application Nos. 60/687,606, filed June 3, 2005, 60/690,268, filed June 14, 2005, 60/692,890, filed June 22, 2005, and 60/694,371, filed June 27, 2005, all of which are entitled Digital Picture Taking Optical Reader Having Hybrid Monochrome And Color Image Sensor, and all of which are incorporated herein by reference.

[0081] In the embodiment of Figs. 7a-7c, the EIR terminal 100 is in the form of a transaction terminal which may be configured as a retail purchase transaction terminal or as a price verifier. Housing 102 of the transaction terminal shown in Figs. 7a-7c is configured to be portable so that it can be moved from location to location and is further configured to be replaceably mounted on a fixed structure such as a fixed structure of a cashier station or a fixed structure of the retail store floor (*e.g.*, a shelf, a column 264 best viewed in Fig. 8b). Referring to bottom view of Fig. 7c, the housing 102 of the EIR terminal 100 has formations 268 facilitating the replaceable mounting of EIR terminal 100 on a fixed structure. Referring now to Fig. 7b, EIR terminal 100 includes a display 504 having an associated touch screen 504T, a card reader 1348, an imaging module 360, and a luminous shroud 362. When light from the illumination block (not shown in Fig. 8) strikes luminous shroud 362, the shroud glows to attract attention to the location of imaging assembly. In certain operating modes as indicated in Fig. 8c, the EIR terminal 100 in accordance with any of Figs. 7a-7c, displays on display 504 a PIN entry screen prompting a customer to enter PIN information into touch screen 504T. In other operating modes, as indicated in Fig. 8d, the EIR terminal 100 displays on display 504 a signature prompt screen prompting a customer to enter signature information into the device with use of a stylus 505.

[0082] Referring to Figs. 8a and 8b, various installation configurations for the EIR terminal of Figs. 7a-7c are shown. In the view of Fig. 8a, the EIR terminal 100 is installed as a retail purchase transaction terminal at a point of sale cashier station. In the setup of Fig. 8a, the EIR terminal 100 is configured as a retail purchase transaction terminal and is utilized

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to aid and facilitate retail transactions at a point of sale. A customer may enter a credit card or a debit card into card reader 1348 and retail purchase transaction terminal may transmit the credit card information to credit/debit authorization network.

[0083] In the view of Fig. 8b, the EIR terminal 100 is configured as a price verifier to aid customers in checking prices of products located on a store floor. EIR terminal 100 may be mounted on a shelf (not shown in Fig. 8b) or on a column 254 or other fixed structure of the retail store. EIR terminal 100 may decode bar code data from bar codes on store products and transmit decoded out bar code messages to a store server for lookup of price information which is sent back from the store server to terminal 100 for display on display 504.

[0084] While the present invention has been particularly shown and described with reference to certain exemplary embodiments, it will be understood by one skilled in the art that various changes in detail may be affected therein without departing from the spirit and scope of the invention as defined by claims that can be supported by the written description and drawings. Further, where exemplary embodiments are described with reference to a certain number of elements it will be understood that the exemplary embodiments can be practiced utilizing less than the certain number of elements.

[0085] A small sample of systems methods and apparatus that are described herein is as follows:

A1. An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

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wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

A2. The EIR terminal of claim A1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

A3. The EIR terminal of claim A1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

A4. The EIR terminal of claim A1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A5. The EIR terminal of claim A1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

A6. The EIR terminal of claim A1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

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A7. The EIR terminal of claim A1 further comprising a central processing unit (CPU);

wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

A8. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

A9. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A10. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A11. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at

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least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of a network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

A12. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of a network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A13. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

A14. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

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wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

A15. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

A16. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

A17. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

A18. The EIR terminal of claim A1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at

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least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to periodically evaluate said user-defined criterion.

A19. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

A20. The EIR terminal of claim A1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

B1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

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B2. The EIR terminal of claim B1, wherein said base-band encoder software program and said base-band decoder software program are implemented as a single software program.

B3. The EIR terminal of claim B1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B4. The EIR terminal of claim B1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

B5. The EIR terminal of claim B1 further comprising a central processing unit (CPU); wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

B6. The EIR terminal of claim B1 further comprising a central processing unit (CPU); wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

B7. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B8. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B9. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

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B10. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B11. The EIR terminal of claim B1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

B12. The EIR terminal of claim B1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

B13. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

B14. The EIR terminal of claim B1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

B15. The EIR terminal of claim B1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

B16. The EIR terminal of claim B1 further configured to periodically evaluate said user-defined criterion.

B17. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

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B18. The EIR terminal of claim B1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

C1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

C2. The EIR terminal of claim C1, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C3. The EIR terminal of claim C1, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

C4. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band encoder software program is performed by at least one of said CPU, a specialized microprocessor.

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C5. The EIR terminal of claim C1 further comprising a central processing unit (CPU);

wherein said base-band decoder software program is performed by at least one of said CPU, a specialized microprocessor.

D1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

D2. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

D3. The EIR terminal of claim D1, wherein said wireless communication interface is implemented using two or more chipsets.

D4. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D5. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

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D6. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a weighted sum of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, and communication channel throughput.

D7. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D8. The EIR terminal of claim D1, wherein said value of said user-defined criterion is calculated as a square root of a weighted sum of squares of components, at least one of said components represented by a difference between an actual value and a desired value of at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

D9. The EIR terminal of claim D1, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

D10. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion before attempting to initiate a communication session.

D11. The EIR terminal of claim D1, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

D12. The EIR terminal of claim D1, wherein said EIR terminal is configured to evaluate said user-defined criterion responsive to a pre-defined event.

D13. The EIR terminal of claim D1 further configured to periodically evaluate said user-defined criterion.

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D14. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

D15. The EIR terminal of claim D1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

E1. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

E2. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

E3. The EIR terminal of claim E1, wherein said wireless communication interface is implemented using two or more chipsets.

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WE CLAIM

1. An encoded information reading (EIR) terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising a radio frequency front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said radio frequency front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said base-band encoder software program is configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control;

wherein said DAC is configured to output to said radio frequency front end an analog signal corresponding to said first encoded bit stream;

wherein said ADC is configured to output a second encoded bit stream corresponding to an analog signal produced by said radio frequency front end; and

wherein said base-band decoder software program is configured to produce a second bit stream corresponding to said second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

2. The EIR terminal of claim 1, wherein said EIR terminal is devoid of dedicated hardware components configured to implement at least one of the following functions: source encoding of said first bit stream, encryption, channel encoding, multiplexing, modulation,

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frequency spreading, media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

3. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

4. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

5. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

6. The EIR terminal of claim 1 further comprising a wireless communication protocol selector software program, said wireless communication protocol software program configured to optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol;

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wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

7. The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

8. The EIR terminal of claim 1 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

9. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

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10. The EIR terminal of claim 9, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

11. The EIR terminal of claim 9, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

12. The EIR terminal of claim 9, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

13. The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to a user action.

14. The EIR terminal of claim 9 further configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to scanning a pre-defined bar code.

15. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface comprising an RF front end configured to perform at least one of receiving a first radio signal and transmitting a second radio signal, said RF front end electrically coupled to at least one of an analog-to-digital converter (ADC) electrically coupled to said system bus and a digital-to-analog converter (DAC) electrically coupled to said system bus;

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wherein said microprocessor is configured to execute at least one of a base-band encoder software program and a base-band decoder software program;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

16. The EIR terminal of claim 15, wherein said base-band encoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

17. The EIR terminal of claim 15, wherein said base-band decoder software program is performed by at least one of a general purpose microprocessor, a specialized microprocessor.

18. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to execute a wireless communication protocol selector software program, said wireless communication protocol selector software program configured optimize a value of a user-defined criterion in order to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol.

19. The EIR terminal of claim 18, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

20. The EIR terminal of claim 18, wherein said wireless communication interface is implemented using two or more chipsets.

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21. The EIR terminal of claim 18, wherein said value of said user-defined criterion is calculated based on at least one of network status, communication quality, signal strength, service cost, bandwidth, a user preference, and communication channel throughput.

22. The EIR terminal of claim 18, wherein said EIR terminal is configured to search beacon signals over a pre-defined frequency range, and then select at least one of a wireless communication network and frequency channel which optimizes said user-defined criterion.

23. The EIR terminal of claim 18, wherein said EIR terminal is configured to switch at least one of said wireless communication network and said wireless communication protocol responsive to evaluating said user-defined criterion.

24. An encoded information reading terminal comprising:

a microprocessor electrically coupled to a system bus;

a memory communicatively coupled to said microprocessor;

an encoded information reading (EIR) device selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device, said EIR device configured to perform at least one of outputting raw message data containing an encoded message and outputting decoded message data corresponding to an encoded message; and

a wireless communication interface configured to support at least two wireless communication protocols;

wherein said EIR terminal is configured to dynamically select at least one of a wireless communication network, a wireless communication protocol, and a parameter of a wireless communication protocol responsive to at least one of a user action, scanning a pre-defined bar code.

25. The EIR terminal of claim 24, wherein said wireless communication interface is implemented using a single multi-protocol chipset.

26. The EIR terminal of claim 24, wherein said wireless communication interface is implemented using two or more chipsets.

TransCore LP
Exhibit 1023 (Page 441)

ABSTRACT

An encoded information reading (EIR) terminal can comprise a microprocessor electrically coupled to a system bus, a memory communicatively coupled to the microprocessor, an encoded information reading (EIR) device, and a wireless communication interface. The EIR device can be selected from the group consisting of a bar code reading device, an RFID reading device, and a card reading device. The EIR device can be configured to perform outputting raw message data containing an encoded message and/or outputting decoded message data corresponding to an encoded message. The wireless communication interface can comprise a radio frequency front end configured to perform receiving a first radio signal and/or transmitting a second radio signal. The radio frequency front end can be electrically coupled to an analog-to-digital converter (ADC) which can be electrically coupled to the system bus and/or to a digital-to-analog converter (DAC) which can be electrically coupled to the system bus. The microprocessor can be configured to execute a base-band encoder software program and/or a base-band decoder software program. The base-band encoder software program can be configured to produce a first encoded bit stream by performing at least one of the following functions: source encoding of a first bit stream, encryption, channel encoding, multiplexing, modulation, frequency spreading, and media access control. The DAC can be configured to output to the radio frequency front end an analog signal corresponding to the first encoded bit stream. The ADC can be configured to output a second encoded bit stream corresponding to an analog signal produced by the radio frequency front end. The base-band decoder software program can be configured to produce a second bit stream corresponding to the second encoded bit stream by performing at least one of the following functions: media access control, frequency de-spreading, de-modulation, de-multiplexing, channel decoding, decryption, and source decoding.

TransCore LP
Exhibit 1023 (Page 442)

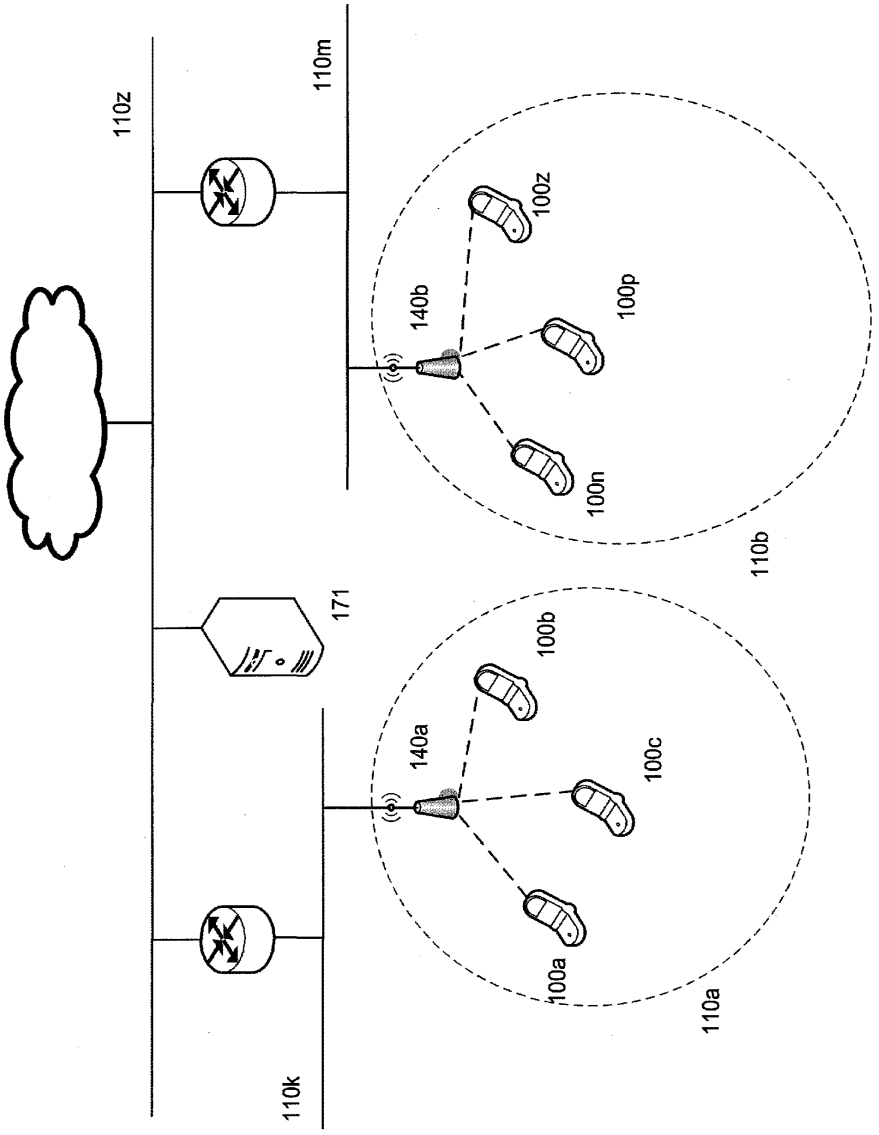

110z
110m
100z
140b
100p
100n
110b
171
100b
140a
100c
100a
110a
110k

Fig. 1

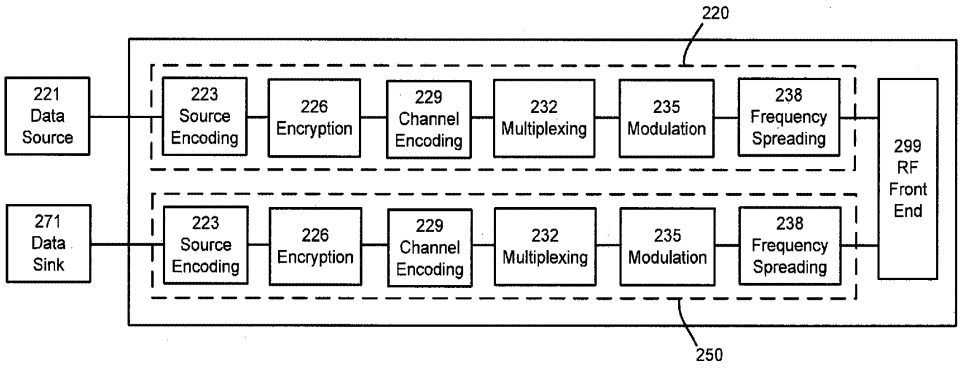


Fig. 2

Docket No. H0032017
Yojiro P. Wakai et al.
For: Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication
Attorney of Record: George S. Blasiak
Telephone: (315) 425-9000

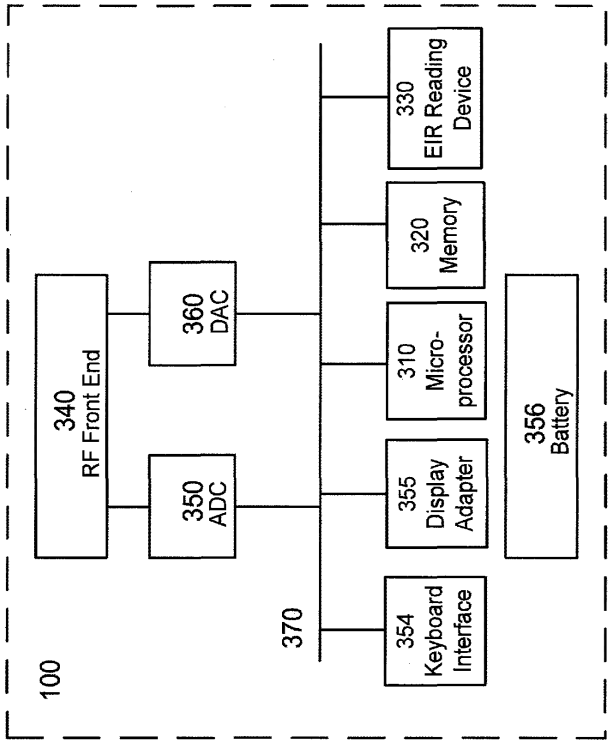

100
340
RF Front End
360
DAC
350
ADC
370
354
Keyboard
Interface
355
Display
Adapter
310
Micro-
processor
320
Memory
330
EIR Reading
Device
356
Battery

Fig. 3

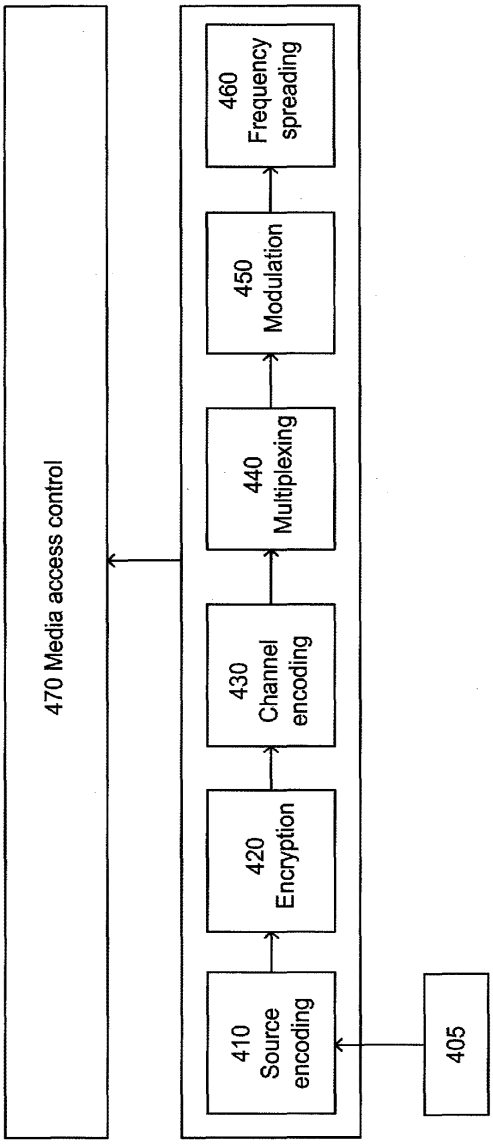

470 Media access control
460 Frequency spreading
450 Modulation
440 Multiplexing
430 Channel encoding
420 Encryption
410 Source encoding
405

Fig. 4

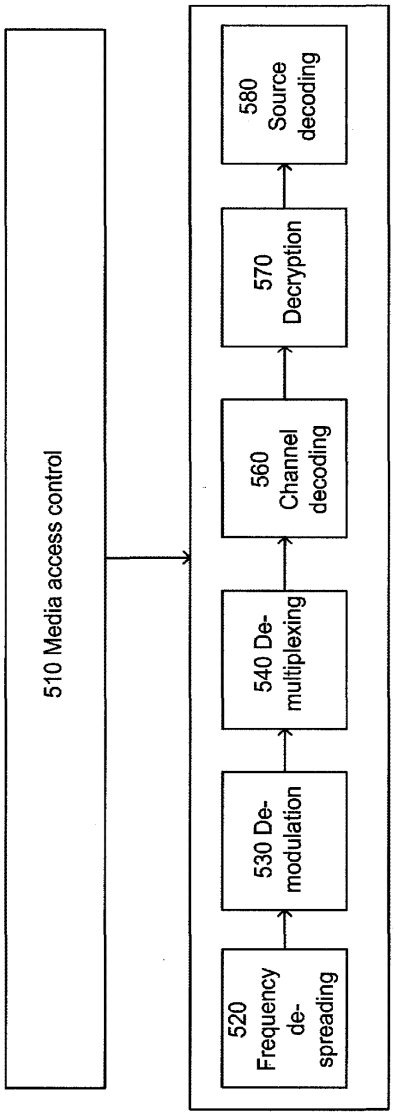

510 Media access control
520 Frequency de-spreading
530 De-modulation
540 De-multiplexing
560 Channel decoding
570 Decryption
580 Source decoding

Fig. 5

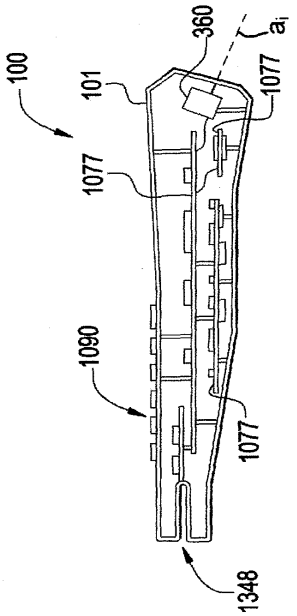

100
101
360
a_i
1077
1077
1090
1077
1348

FIG. 6b

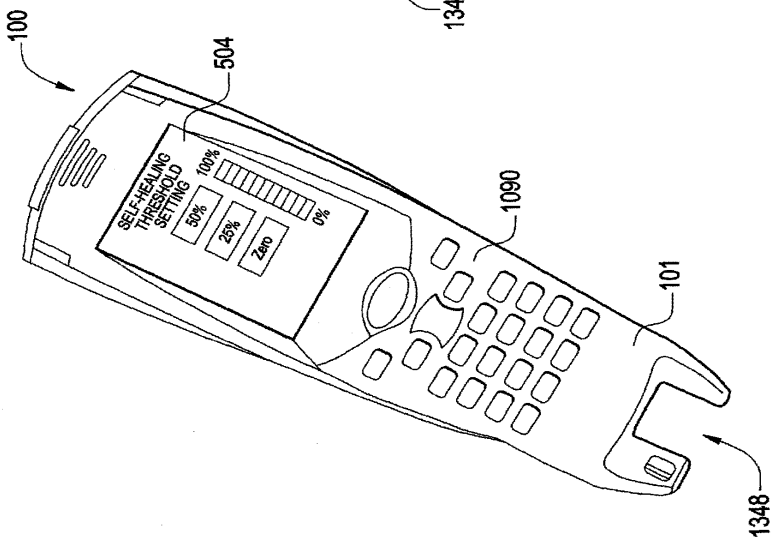

100
504
SELF-HEALING THRESHOLD SETTING
100%
50%
25%
Zero
0%
1090
101
1348

FIG. 6a

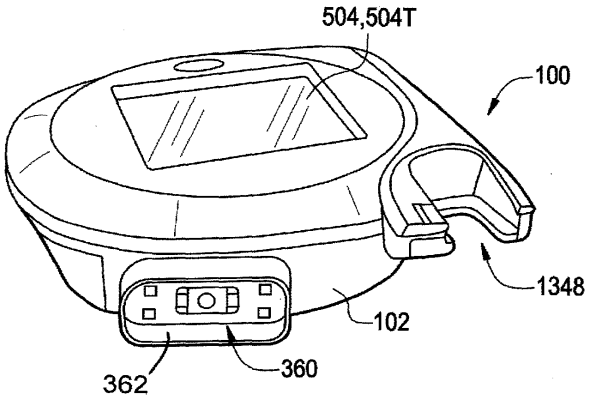


FIG. 7b

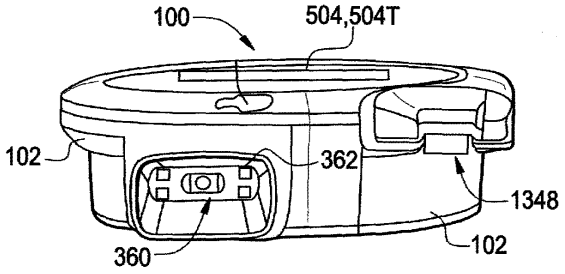


FIG. 7a

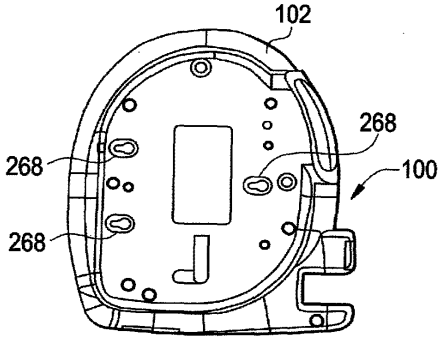


FIG. 7c

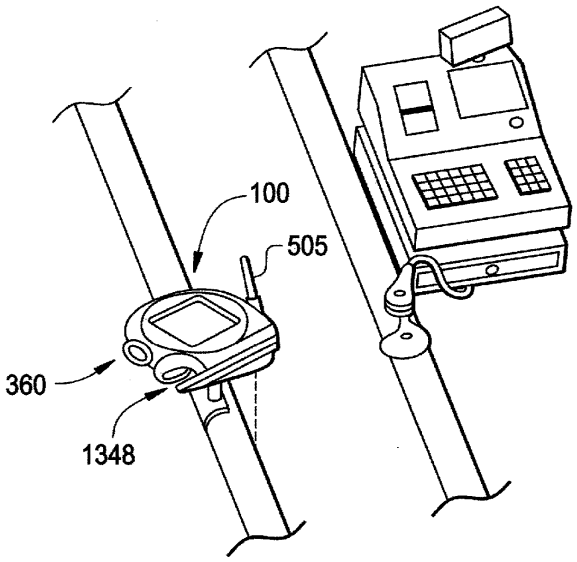


FIG. 8a

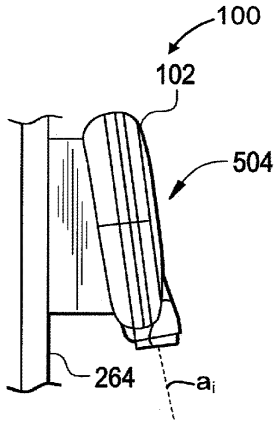


FIG. 8b

FIG. 8c

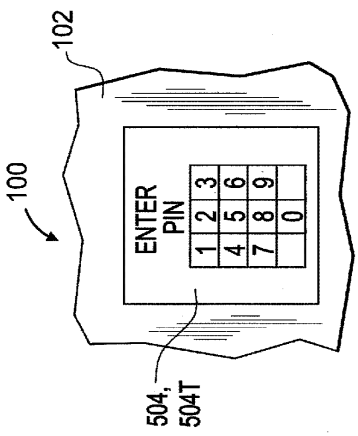
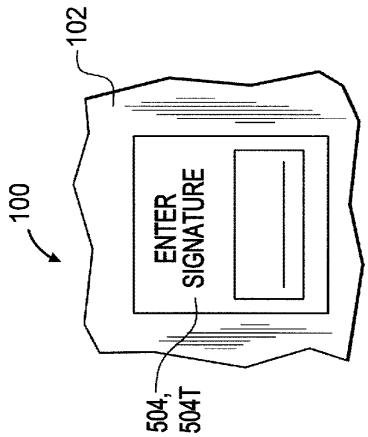

100
102
ENTER PIN
1 2 3
4 5 6
7 8 9
0
504, 504T

FIG. 8d


100
102
ENTER SIGNATURE
504, 504T

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Dated: September 25, 2009
Electronic Signature for Barbara A. Saltsman: /Barbara A. Saltsman/

Docket No.: H0022017
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Ynjiun P. Wang et al.

Application No.: Not Yet Assigned — Confirmation No.: N/A

Filed: Concurrently Herewith — Art Unit: N/A

For: Encoded Information Reading Terminal With User-Configurable Multi-Protocol Wireless Communication Interface — Examiner: Not Yet Assigned

INFORMATION DISCLOSURE STATEMENT (IDS)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The references cited on attached form PTO/SB/08A/B are being called to the attention of the Examiner.

It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the “references cited” on any patent to issue therefrom.

As provided for by 37 CFR §1.97(h), no inference should be made that the information and references cited are material to patentability. Also, no inference should be made that a reference is prior art merely because it is included in this statement. Under 37 CFR §1.97(g), the submission of an information disclosure statement should not be considered as representation that a search has been made.

Applicants believe no fee is required with this submission. The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-0289.

Dated: September 25, 2009

Respectfully submitted,

Electronic signature: /George S. Blasiak/
George S. Blasiak
Registration No.: 37,283
Marjama Muldoon Blasiak & Sullivan LLP
250 South Clinton Street
Suite 300
Syracuse, New York 13202
(315) 425-9000
Customer No.: 00128

GSB/bs

PTO/SB/08a (07-09)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 3

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Ynjiun P. Wang
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA*	US-5,579,341	11-26-1996	Smith et al.	
	AB*	US-5,812,605	09-22-1998	Smith et al.	
	AC*	US-5,903,825	05-11-1999	Goode et al.	
	AD*	US-6,167,099	12-26-2000	Rader et al.	
	AE*	US-20020055368	05-09-2002	Lee	
	AF*	US-6,751,470	06-15-2004	Ella et al.	
	AG*	US-20050271133	12-08-2005	Waxman	
	AH*	US-20060128332	06-15-2006	van Rooyen et al.	
	AI*	US-20060135084	06-22-2006	Lee	
	AJ*	US-20060279446	12-14-2006	Wang et al.	
	AK*	US-7,190,728	03-13-2007	Kawada et al.	
	AL*	US-7,218,678	05-15-2007	Katta et al.	
	AM*	US-7,283,094	10-16-2007	Lee	
	AN*	US-20080107213	05-08-2008	Gupta et al.	
	AO*	US-20080297404	12-04-2008	Lin et al.	
	AP*	US-20090024550	01-22-2009	Wynn et al.	
	AQ*	US-20090028082	01-29-2009	Wynn et al.	
	AR*	US-20090067388	03-12-2009	van Rooyen et al.	
	AS*	US-20090074106	03-19-2009	See et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

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IDS (Citation) by Applicant (21 References)

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Sheet 2 of 3

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Ynjiun P. Wang
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	H0022017

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AT*	US-20090115549	05-07-2009	Lee	
	AU*	US-20090180403	07-16-2009	Tudosoiu	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 3 of 3

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Ynjiun P. Wang
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	H0022017

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[2]

Examiner Signature		Date Considered	

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[1] Applicant's unique citation designation number (optional). [2] Applicant is to place a check mark here if English language Translation is attached.

Electronic Patent Application Fee Transmittal	
Application Number:	
Filing Date:	
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Filer:	George S. Blasiak/Barbara Saltsman
Attorney Docket Number:	H0022017
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	330	330
Utility Search Fee	1111	1	540	540
Utility Examination Fee	1311	1	220	220
Pages:				
Claims:				
Claims in excess of 20	1202	6	52	312
Independent claims in excess of 3	1201	2	220	440
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1842**

Electronic Acknowledgement Receipt	
EFS ID:	6148499
Application Number:	12567158
International Application Number:	
Confirmation Number:	3751
Title of Invention:	ENCODED INFORMATION READING TERMINAL WITH USER-CONFIGURABLE MULTI-PROTOCOL WIRELESS COMMUNICATION INTERFACE
First Named Inventor/Applicant Name:	Ynjiun P. Wang
Customer Number:	00128
Filer:	George S. Blasiak/Barbara Saltsman
Filer Authorized By:	George S. Blasiak
Attorney Docket Number:	H0022017
Receipt Date:	25-SEP-2009
Filing Date:	
Time Stamp:	15:30:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1842
RAM confirmation Number	1767
Deposit Account	500289
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Transmittal of New Application	Transmittal.pdf	40285 2b2d21ac8c6e5c4e206f507b1fa23c7b79cb5a7a	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	FeeTransmittal.pdf	45682 21976b60ce3e993117c0969961ceab4c7736c2ce	no	1
Warnings:					
Information:					
3	Application Data Sheet	ADS.pdf	21046 6581acb0d52499be839777fee81e89e177329166	no	4
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
4	Authorization to access Appl. by Trilateral Office	PTO39.pdf	29648 dee866d07dc887d73395ff1f7f63c8273a3ed947	no	1
Warnings:					
Information:					
5	Oath or Declaration filed	DEC.pdf	218603 5ea9dc576dcb00154e3e270d53b32b9ae9b68d59	no	5
Warnings:					
Information:					
6		Application.pdf	169000 363ad432af1b712c1bb46816e5e52c2004f84140	yes	35

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	28
	Claims	29	34
	Abstract	35	35

Warnings:					
Information:					
7	Drawings-only black and white line drawings	Drawings.pdf	204816 83efa94e6998c928221ab05fbe7967a137946755	no	9
Warnings:					
Information:					

8	Transmittal Letter	IDS.pdf	17866 baab6be63493f085d23d7fa8f89f3b27f971d98c	no	2
Warnings:					
Information:					
9	Information Disclosure Statement (IDS) Filed (SB/08)	SB08.pdf	56760 dbdeed5935dbe7c888dcefcc193704bed991b82f	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
10	Fee Worksheet (PTO-875)	fee-info.pdf	38261 0fea63996ca93dbc1044845c2b529b8134304d3c	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	841967		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (12-04)

Filing Date: 09/25/09

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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 12/567,158

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	**330**
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	**540**
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	**220**
TOTAL CLAIMS (37 CFR 1.16(i))	**26** minus 20 =	**6**	x$26		OR	x$52	**312**
INDEPENDENT CLAIMS (37 CFR 1.16(h))	**5** minus 3 =	* **2**	x$110			x$220	**440**
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $270 ($135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			195			390	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	**1842**

APPLICATION AS AMENDED – PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

TransCore LP
Exhibit 1023 (Page 462)