US 20060098666A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2006/0098666 A1**

Francis Conde Powell (43) **Pub. Date: May 11, 2006**

(54) **PORTABLE DEVICE CONFIGURATION SYSTEM**

(76) Inventor: **Justin Mark Francis Conde Powell**, Danvers, MA (US)

Correspondence Address:
JACK SCHWARTZ & ASSOCIATES
1350 BROADWAY, SUITE 1510
NEW YORK, NY 10018 (US)

(21) Appl. No.: **11/257,497**

(22) Filed: **Oct. 24, 2005**

Related U.S. Application Data

(60) Provisional application No. 60/621,809, filed on Oct. 25, 2004.

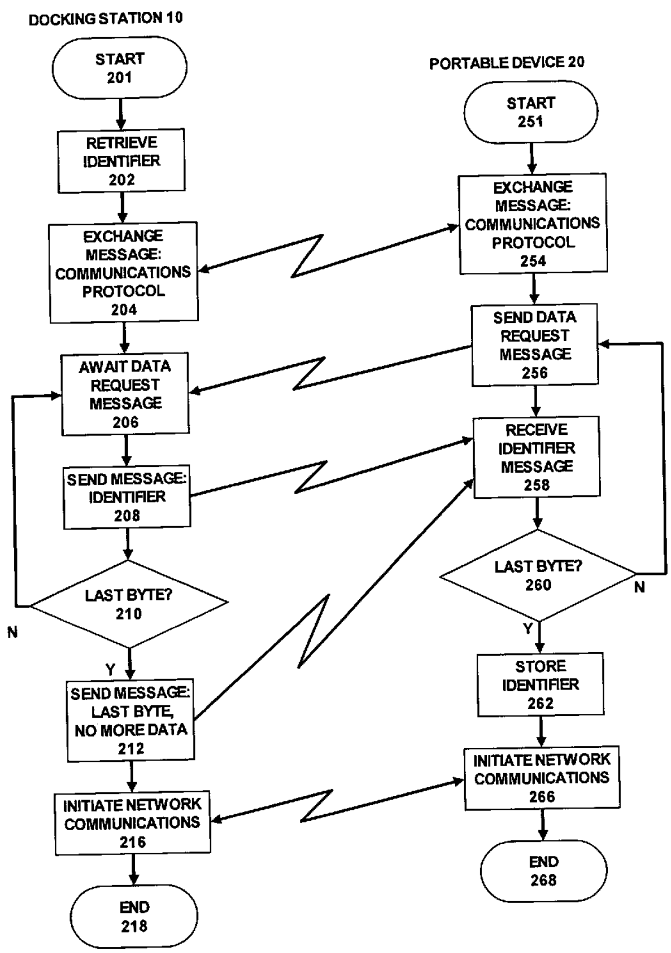
Publication Classification

(51) **Int. Cl.**
H04L 12/56 (2006.01)
H04L 12/413 (2006.01)
H04L 12/28 (2006.01)

(52) **U.S. Cl.** **370/401**; 370/445

(57) **ABSTRACT**

A system for communicating a parameter from a first device to a second device includes an input processor for receiving data indicating a parameter. An interface processor, used by the first device, communicates a first message to the second device including data identifying a communication protocol to be used in communicating with the first device, This message also indicates that additional data is available for acquisition. The interface processor communicates the parameter to the second device in one or more separate messages in response to one or more corresponding data request messages from the second device. The data request messages are initiated by the second device in response to data being received from the first device indicating that additional data is available for acquisition. In response to receiving data indicating that the parameter has been acquired by said second device, the interface processor updates the message data for communication to the second device to indicate additional data is unavailable for acquisition.



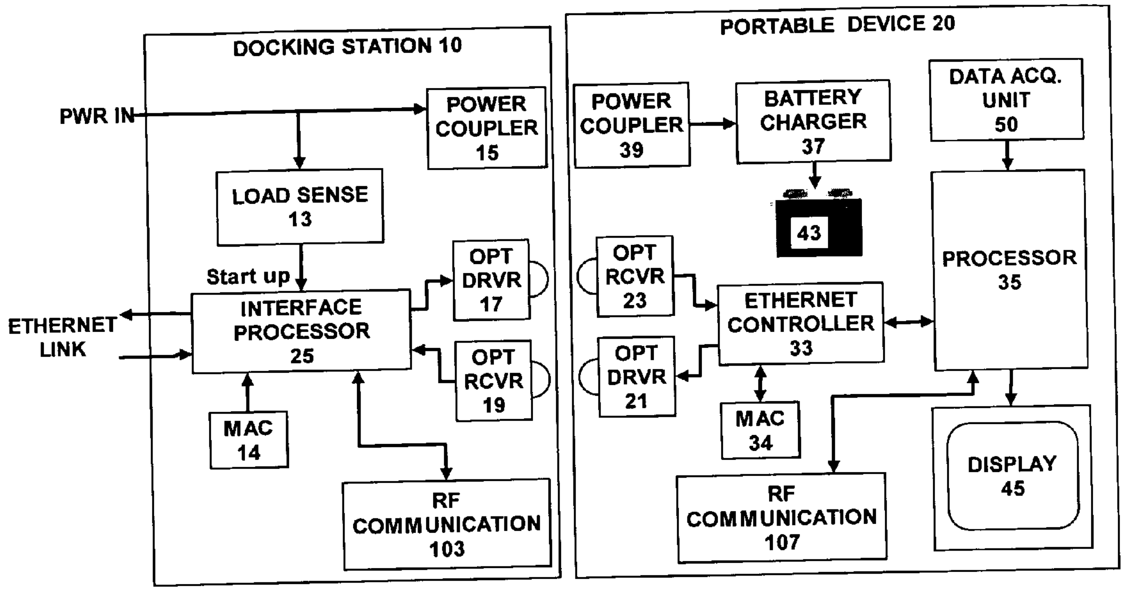

DOCKING STATION 10
PWR IN
POWER COUPLER 15
LOAD SENSE 13
Start up
OPT DRVR 17
ETHERNET LINK
INTERFACE PROCESSOR 25
OPT RCVR 19
MAC 14
RF COMMUNICATION 103
PORTABLE DEVICE 20
POWER COUPLER 39
BATTERY CHARGER 37
DATA ACQ. UNIT 50
43
OPT RCVR 23
ETHERNET CONTROLLER 33
PROCESSOR 35
OPT DRVR 21
MAC 34
RF COMMUNICATION 107
DISPLAY 45

Fig. 1

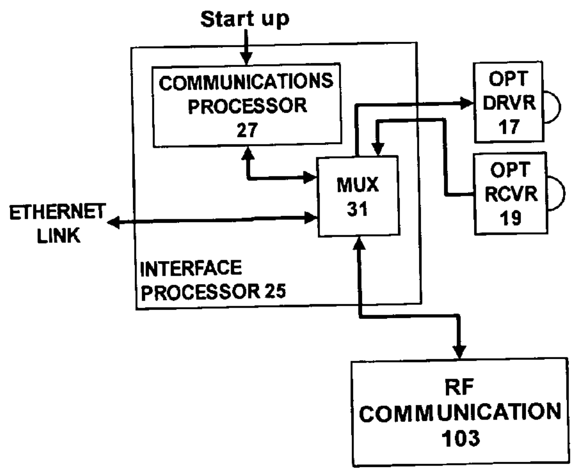

Start up
COMMUNICATIONS PROCESSOR 27
OPT DRVR 17
MUX 31
OPT RCVR 19
ETHERNET LINK
INTERFACE PROCESSOR 25
RF COMMUNICATION 103

Fig. 2

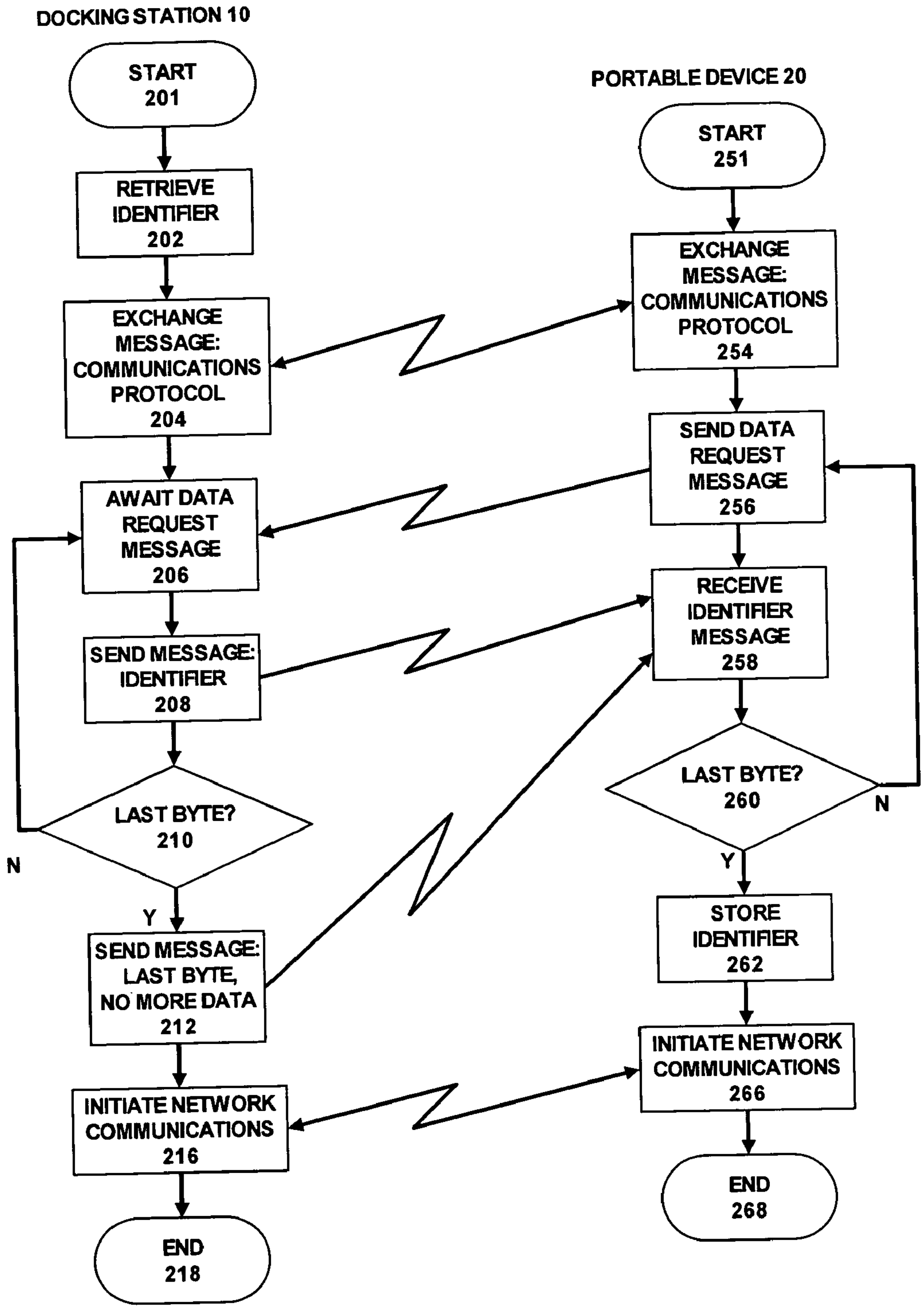

DOCKING STATION 10
START 201
RETRIEVE IDENTIFIER 202
EXCHANGE MESSAGE: COMMUNICATIONS PROTOCOL 204
AWAIT DATA REQUEST MESSAGE 206
SEND MESSAGE: IDENTIFIER 208
LAST BYTE? 210
N
Y
SEND MESSAGE: LAST BYTE, NO MORE DATA 212
INITIATE NETWORK COMMUNICATIONS 216
END 218
PORTABLE DEVICE 20
START 251
EXCHANGE MESSAGE: COMMUNICATIONS PROTOCOL 254
SEND DATA REQUEST MESSAGE 256
RECEIVE IDENTIFIER MESSAGE 258
LAST BYTE? 260
N
Y
STORE IDENTIFIER 262
INITIATE NETWORK COMMUNICATIONS 266
END 268

Fig. 3

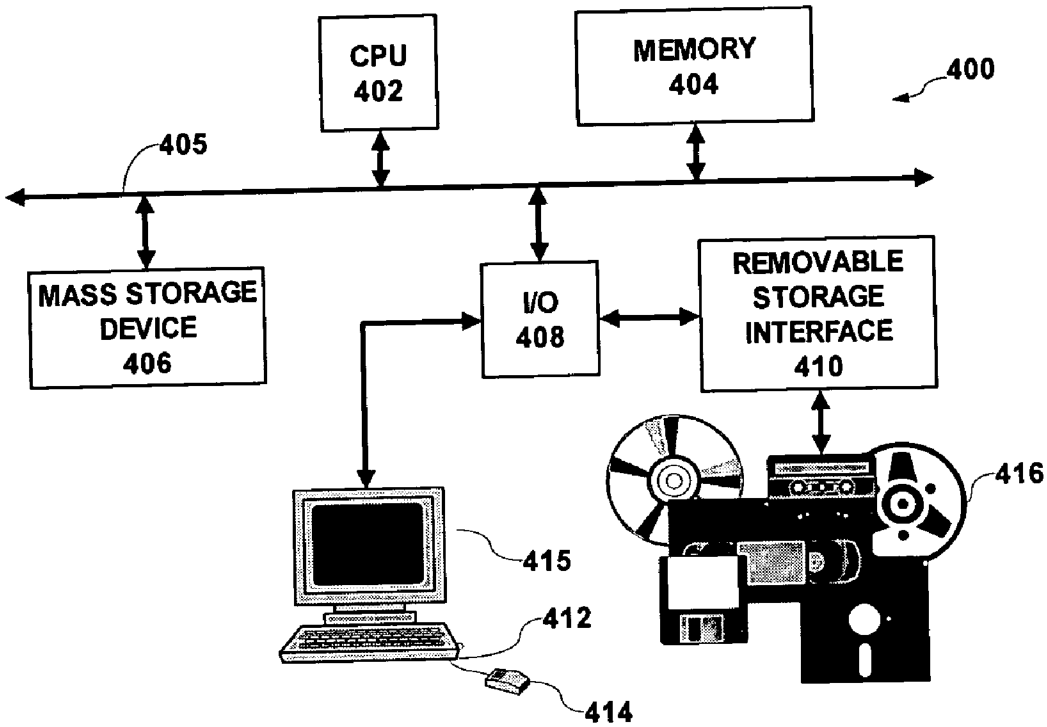

CPU
402
MEMORY
404
400
405
MASS STORAGE
DEVICE
406
I/O
408
REMOVABLE
STORAGE
INTERFACE
410
416
415
412
414

Fig. 4

PORTABLE DEVICE CONFIGURATION SYSTEM

CROSS-REFERENCED TO RELATED APPLICATION

[0001] This is a non-provisional application of U.S. Provisional Application Ser. No. 60/621,809 filed Oct. 25, 2004.

FIELD OF THE INVENTION

[0002] The present invention relates to a system for exchanging configuration data with a portable device, and in particular for exchanging communications configuration data with a portable device upon initial connection of the portable device to the system.

BACKGROUND OF THE INVENTION

[0003] Portable devices are able to perform operations while remaining unconnected to other devices. Such portable devices are often physically connectable to a base system via a receptacle, termed a dock or holster. In many cases, the base system includes a communications network of interconnected nodes, such as a local area network (LAN) and/or a wide area network (WAN) e.g. the internet, to which the receptacle is connected. When the portable device is connected to the receptacle, termed docked, a communications channel is established to enable the portable device to communicate with the communications network via the receptacle. In order to minimize communications overhead, the portable device is configured to operate as a node on the communications network, and the receptacle is configured to act as a conduit for passing, but not processing, messages between the portable device and the communications network.

[0004] The communications protocol typically used for the communications network is the Ethernet protocol. Several versions of this protocol exist in current practical implementations (e.g. 10 Mbps such as 10Base2, 10BaseT and 10BaseF; 100 MBps; Gigabit, etc.). In addition, Ethernet protocols are available for both wired and wireless communications links. As added speed and features become available, it is expected that further versions will become available in the future. Different versions may not be used over the same communications link simultaneously. Thus, new equipment attached to an existing system must be configured to use the same Ethernet version as the equipment to which it is attached.

[0005] Networking equipment has been developed which can support different versions, e.g. 10 Mbps, 100 Mbps and 1000 Mbps, and can operate with communications networks using any of the supported Ethernet versions, including wired or wireless.

BRIEF SUMMARY OF THE INVENTION

[0006] A procedure has been developed to automatically determine the capabilities of newly connected networking equipment and to concurrently broadcast the capabilities of the networking equipment to which the new equipment is attached. An automatic negotiation of the highest capability version which both pieces of networking equipment support is performed. Such a procedure is termed auto-negotiation as defined by Clause 28 of the D4 draft of the *ANSI/IEEE Std* 802.3 *MAC Parameters, Physical Layer, Medium Attachment Units and Repeater for* 100 *Mb/s Operation.*

[0007] Existing solutions provide circuitry to transmit a unique identifier, termed a media access control (MAC) address in Ethernet communications networks, from the receptacle to the portable device. However, such circuitry adds cost, complexity, and size to such equipment, increases power dissipation and decreases reliability. A system according to invention principles addresses these deficiencies and related problems.

[0008] The inventor advantageously realized that the Ethernet auto-negotiation process provides for transferring information between a communications network and a newly connected node in addition to negotiating the communications protocol, e.g. Ethernet version, to be used on that link. In this manner, parameters may be transferred between equipment connected to the network and newly connected equipment before network communications is initiated.

[0009] In accordance with principles of the present invention, a system for communicating a parameter from a first device to a second device includes an input processor for receiving data indicating a parameter. An interface processor, used by the first device, communicates a first message to the second device including data identifying a communication protocol to be used in communicating with the first device, This message also indicates that additional data is available for acquisition. The interface processor communicates the parameter to the second device in one or more separate messages in response to one or more corresponding data request messages from the second device. The data request messages are initiated by the second device in response to data being received from the first device indicating that additional data is available for acquisition. In response to receiving data indicating that the parameter has been acquired by the second device, the interface processor updates the message data for communication to the second device to indicate additional data is unavailable for acquisition.

[0010] A system according to principles of the present invention may transfer a unique identifier, for example an identifier necessary to uniquely identify a node on a network, such as a Ethernet MAC address, from a receptacle to a portable device using the auto-negotiation process before network communications is initiated.

BRIEF DESCRIPTION OF THE DRAWING

[0011] In the drawing:

[0012] **FIG. 1** is a block diagram of a portable device configuration system according to principles of the present invention;

[0013] **FIG. 2** is a more detailed block diagram of an interface processor which may be used in the system illustrated in **FIG. 1** according to principles of the present invention;

[0014] **FIG. 3** is a flow chart useful in understanding the operation of the system illustrated in **FIG. 1** and **FIG. 2** according to principles of the present invention; and

[0015] **FIG. 4** is a block diagram of a computer system on which the portable device configuration system illustrated in **FIG. 1** and **FIG. 2** according to principles of the present invention may be implemented.

DETAILED DESCRIPTION OF THE INVENTION

[0016] A processor, as used herein, operates under the control of an executable application to (a) receive information from an input information device, (b) process the information by manipulating, analyzing, modifying, converting and/or transmitting the information, and/or (c) route the information to an output information device. A processor may use, or comprise the capabilities of, a controller or microprocessor, for example. The processor may operate with a display processor or generator. A display processor or generator is a known element for generating signals representing display images or portions thereof. A processor and a display processor comprises any combination of, hardware, firmware, and/or software.

[0017] An executable application, as used herein, comprises code or machine readable instructions for conditioning the processor to implement predetermined functions, such as those of an operating system, portable device configuration system or other information processing system, for example, in response user command or input. An executable procedure is a segment of code or machine readable instruction, sub-routine, or other distinct section of code or portion of an executable application for performing one or more particular processes. These processes may include receiving input data and/or parameters, performing operations on received input data and/or performing functions in response to received input parameters, and providing resulting output data and/or parameters.

[0018] One environment in which portable devices find use is in a medical environment such as a hospital. Physiological parameters (i.e. heart rate, blood pressure, SpO_2, EKG, respiration, etc.) of patients are typically monitored in a hospital environment. For some acutely ill patients, such monitoring is continual with a relatively short sampling interval, even as the patient is transported from one location in the hospital to another. Portable patient monitors have been developed which may remain with the patient. Such portable patient monitors are typically battery powered and are capable of monitoring physiological parameters, displaying them for attending clinicians, and saving the results for later review.

[0019] However, hospitals also maintain central locations, connected to a hospital communications network, where patient physiological parameters may be monitored and/or stored over the length of the patient's stay. Such hospitals have receptacles, termed docking stations or holsters, for portable patient monitors at fixed locations, such as patient rooms, therapy rooms, operating rooms, etc. These receptacles are connected to the hospital communications network. When the patient is in one of those locations, the portable patient monitor may be placed in the receptacle. While in the receptacle, the batteries in the patient monitor are recharged and the patient monitor is connected to the hospital communications network. Any physiological parameters gathered while the portable patient monitor is not connected to the communications network may be transmitted to the central location for storage and physiological parameters sampled while the portable patient monitor is inserted in the receptacle may be sent to the central location as they are gathered.

[0020] As described above, when a portable patient monitor is docked to a docking station, a communications channel is established between the docked portable patient monitor and the hospital communications network. In this communications channel, the portable patient monitor operates as a network node and the docking station operates as a repeater. Also as described above, this requires that a unique identifier be transferred from the docking station to the portable patient monitor before communications may be initiated between the portable patient monitor and the hospital communications network. Because the unique identifier is associated with the docking station, this also advantageously enables determination of the geographic location of the particular docking station from a map, maintained at the central location, associating the unique identifier with the corresponding geographic location of the docking station.

[0021] **FIG. 1** is a block diagram of a portable device configuration system according to principles of the present invention. In **FIG. 1**, a docking station **10** includes power input terminal coupled to a source of electrical power (not shown). The power input terminal is coupled to respective input terminals of a load sense circuit **13** and a power coupler **15**. The docking station **10** also includes a bidirectional terminal coupled to an Ethernet link to the hospital communications system (also not shown). The Ethernet link bidirectional terminal is coupled to respective corresponding bidirectional terminals of an interface processor **25**. A second bidirectional terminal of the interface processor **25** is coupled an optical communications link. More specifically, an output terminal of the interface processor **25** is coupled to an optical driver **17** and an input terminal of the interface processor **25** is coupled to an optical receiver **19**. A first control input terminal, receiving a "Start up" signal, is coupled to an output terminal of a load sense circuit **13**. A second control input terminal is coupled to a source **14** of a unique identifier.

[0022] A portable device **20** includes a power coupler **39**. An output terminal of the power coupler **39** is coupled to an input terminal of a battery charger **37**. An output terminal of the battery charger **37** is coupled to a battery **43**. The portable device **20** also includes a processor **35**. An output terminal of a data acquisition unit **50** is coupled to an input terminal of the processor **35**. An output terminal of the processor is coupled to a display device **45**. A first bidirectional terminal of the processor **35** is coupled to a corresponding terminal of an Ethernet controller **33**. A second bidirectional terminal of the Ethernet controller **33** is coupled to an optical link. More specifically, an output terminal of the Ethernet controller **33** is coupled to an optical driver **21** and an input terminal of the Ethernet controller **33** is coupled to an optical receiver **23**. A second bidirectional terminal of the processor **35** is coupled to an RF communications circuit **107**. A bidirectional control terminal of the Ethernet controller **33** is coupled to a store **34** containing a unique identifier.

[0023] In operation, when the portable device **20** is undocked, the battery **43** provides the power to the portable device **20**. In a medical environment, the portable device is a portable patient monitor. In a portable patient monitor, the data acquisition unit **50** is coupled to sensors (not shown) attached to the patient, and/or to patient monitoring and/or treatment devices operating on the patient. The data acquisition unit **50** processes patient parameter data such as physiological data including (a) electro-cardiograph (ECG) data, (b) blood parameter data, (c) ventilation parameter data, (d) infusion pump related data, (e) blood pressure data, (f) pulse rate data, (g) temperature data, and other similar patient parameter data. The processor **35** generates signals representing images for displaying the patient physiological parameter data. These image representative signals are supplied to the display device **45** which displays the image representing the patient physiological parameter data for the clinician. In addition, the processor **35** may include memory (not shown) for storing the patient physiological parameter data. The patient physiological parameter data may also be transmitted from the processor **35** to the hospital communications network via access points connected via the RF communications link **107**.

[**0024**] When the portable device **20** is inserted into the docking station **10**, i.e. docked, as illustrated in **FIG. 1**, the interface processor **25** initiates a first mode of operation to establish communications between the portable device **20** and the hospital communications network, in a manner to be described in more detail below. In this mode of operation, as described above, it is necessary to communicate the unique identifier of the docking station **10** to the portable device **20**. This is done using the Ethernet compatible auto-negotiation process. The auto-negotiation process identifies a communications protocol acceptable to both the docking station and the portable device, and also communicates the docking station **10** unique identifier to the portable device **20**.

[**0025**] When the first mode of operation is completed, the interface processor **25** in the docking station subsequently initiates operation in a second mode of operation establishing a connection between the portable device **20** and the hospital communications network using the acceptable communications protocol. In this mode of operation, the interface processor **25** initiates communications between the portable device **20** and the docking station **10**. The interface processor **25** may communicate by either (i) wireless and (ii) wired communication. More specifically, in the illustrated embodiment, after the unique identifier has been communicated from the docking station **10** to the portable device **20**, the interface processor **25** in the docking station **10** may communicate with the portable device **20** using the optical link **17**, **19**, **21**, **23**, and/or using the RF communication circuits **103** and **107**. One skilled in the art understands that any RF wireless technology may be used to implement the RF wireless link, such as (a) WLAN 802.11b standard compatible communication, (b) 802.3 standard compatible communication, (c) 802.11 standard compatible communication, (d) Bluetooth 802.15 standard compatible communication, and (e) GSM/GPRS standard compatible communication.

[**0026**] When operating in the second mode of operation, the docking station operates as a repeater, passing data between the portable device **20** and the hospital communications network without processing it. Patient parameter data gathered when the portable device **20** was undocked is downloaded to the hospital communications network for storage in the central location. Similarly, patient parameter data gathered while the portable device **20** is docked is sent immediately to the central location via the hospital communications network.

[**0027**] **FIG. 2** is a more detailed block diagram of an interface processor **25** which may be used in the system illustrated in **FIG. 1**. In **FIG. 2**, the "Start up" signal from the load sense circuit **13** (**FIG. 1**) is coupled to an input terminal of a communications processor **27**. A bidirectional terminal of the communications processor **27** is coupled to a first bidirectional terminal of a multiplexer **31**. The Ethernet link to the hospital communications system is coupled to a second selectable terminal of the multiplexer **31**. A second bidirectional terminal of the multiplexer **31** is coupled to the optical link. That is, an output terminal of the multiplexer **31** is coupled to the optical driver **17** and an input terminal of the multiplexer **31** is coupled to the optical receiver **19**. A third bidirectional terminal of the multiplexer is coupled to the RF communications circuit **103**

[**0028**] In operation, the "Start up" signal indicates that the portable device **20** is newly docked to the docking station **10**. This signal conditions the communications processor **27** to initiate the first mode of operation. During the first mode of operation, the multiplexer **31** is conditioned to connect the communications processor **27** to the optical driver **17** and optical receiver **19**. During the second mode of operation, the multiplexer **31** is conditioned to couple the Ethernet link to the hospital communications network to either the optical link, e.g. the optical driver **17** and optical receiver **19**, or to the RF link, e.g. the RF communications circuit **103**, depending on which mode of communications is being used. In this way, the docking station **10** is configured to operate as a repeater during the second mode of operation.

[**0029**] Referring again to **FIG. 1**, when the portable device **20** is docked, power is coupled from the docking station **10** to the portable device **20** via the power couplers **15** and **39**. In the illustrated embodiment, the power couplers **15** and **39** form a split transformer. The primary is in the power coupler **15** in the docking station **10** which is magnetically coupled to the secondary in the power coupler **39** in the portable device **20**. When docked, power is coupled to the portable device **20** via the transformer formed by the power couplers **15** and **39**. This power is supplied to the battery charger **37**, which, in turn, charges the battery **43**.

[**0030**] The interface processor **25** may detect that the portable device **20** is attached to the docking station **10** by detecting (a) an active communication link between the portable device **20** and the hospital communications network, (b) an active communication link between the docking station **10** and the portable processing device **20**, and/or (c) that the portable device **20** is docked with the docking station **10** and is receiving electrical power from the docking station **10**. For example, the presence of the portable device **20** may be detected by the docking station **10** by the load sense circuit **13**. When the portable device **20** is undocked, the power coupler **15** in the docking station is a primary winding without a secondary winding and exhibits a relatively higher voltage in response. The load sense circuit **13** can detect the high voltage condition indicating that the portable device is undocked. When the portable device **20** is docked, the power couplers **15** and **39** form a complete transformer. The relatively higher voltage condition on the power coupler **15** is removed. This is detected by the load sense circuit **13**, which generates a "Start up" signal. The "Start up" signal is coupled to the interface processor **25**.

[**0031**] When the presence of the portable device **20** is detected by the docking station **10**, the docking station **10** initiates the process of connecting the processor **35** in the portable device to the hospital communications network via the Ethernet controller **33**, e.g. the first mode of operation described above. This process uses the Ethernet auto-negotiation process. In general, auto-negotiation involves the exchange of messages between a first device such at the docking station **10**, termed a local device (LD), and another device such as the portable device, termed a link partner (LP). In Messages are formed of 16 bit link code words (LCW). The 16 bits of the LCWs are interleaved between 17 clock bits in a predetermined manner termed FM pulse encoding, and the resulting pulse stream is transmitted on the output link terminal at a predetermined pulse rate (12.5 KHz) and repeated at a predetermined repetition rate (16.8 ms). Concurrently, LCWs from the other device are received on the input link terminal.

[**0032**] One bit of the 16 bit LCW, e.g. bit D**14**, has a value (Ack) used to acknowledge of successful receipt of an LCW from the link partner; and another bit, e.g. bit D**15**, has a value, termed NP for "Next Page", used for indicating that addition data is available for acquisition by the link partner. This is illustrated in Table 1 (below). The remaining bits (D**0** through D**13**) are assigned to carry different data depending on the type of data being exchanged: i.e. auto-negotiation of an acceptable communications protocol, or exchange of additional data. The encoding of the LCW, the bit rate, the repetition rate, and the values assigned to the remaining bits in the LCW are standardized and are not described in detail below. In the remaining description LCW[LD] will represent an LCW transmitted from a local device (e.g. docking station **10**) and LCW[LP] will represent an LCW received from the link partner (e.g. portable device **20**). To exchange a message, LCWs are continually transmitted at the predetermined repetition rate according to the process below.

TABLE 1

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
														Ack	NP

[**0033**] Messages are exchanged in the following manner during auto-negotiation. Both the local device (e.g. docking station **10**) and the link partner (e.g. portable device **20**) generate respective LCWs encoding desired data in an appropriate manner. For example, during the first mode of operation, the communications protocols available in the docking station are encoded in the LCW[LD] and the communications protocols available in the portable device **20** are encoded in the LCW[LP]. During the second mode of operation, at least a portion of the unique identifier, such as the MAC address of the docking station **10**, is encoded in the LCW[LD].

[**0034**] To exchange a message, the local device begins by repetitively transmitting its LCW[LD], carrying the desired data, with the Ack bit not set. Once three consecutive matching, LCW[LP]s are received from the link partner (ignoring Ack), the local device sets the Ack bit in the transmitted LCW[LD] to indicate to the link partner that it has received the link partner's LCW[LP] correctly and continues to repetitively transmit that LCW[LD]. Upon receiving three consecutive matching LCW[LP]s with the Ack bit set, the local device knows that the link partner has received the local device's LCW[LD] correctly. The local device transmits the Link Code Word with the Ack bit set **6** to **8** additional times to ensure that a complete message exchange has taken place. This process occurs whenever a message is exchanged as described below.

[**0035**] **FIG. 3** is a flow chart useful in understanding the operation of the system illustrated in **FIG. 1** and **FIG. 2**. In **FIG. 3**, the flow chart on the left hand side represents activities in the docking station **10** (**FIG. 1**) and the flow chart on the right side represents activities in the portable device **20**. With respect to communicating the unique identifier, the portable device **20** operates as a master and the docking station **10** operates as a slave, in a manner to be described in more detail below.

[**0036**] Referring to both **FIG. 1** and **FIG. 3**, the process begins in the docking station **10** at step **201** and in the portable device **20** in step **251**. In step **202**, the interface processor **25** in the docking station **10** retrieves a parameter, from the source **14**. In the illustrated embodiment, the parameter is a unique identifier or electronic address unique to the particular docking station **10**. In the illustrated embodiment, the electronic address is a media access control (MAC) identifier. However, one skilled in the art understands that the electronic address associated with the particular docking station **10** may comprises (a) an Ethernet compatible MAC address, (b) an IP address, (c) a port identifier, (d) an Internet compatible address, (e) a LAN address, or any other similar electronic address which may uniquely identify the particular docking station **10**.

[**0037**] In steps **204** and **254**, the first mode of operation is performed. LCWs are exchanged, in the manner described above, containing data representing the available communications protocols in the docking station **10** and the portable device **20**. A known procedure selects a common communications protocol. In this case, the NP bit is set in the LCW[LD]. Setting the NP bit indicates that additional data is available for acquisition by the portable device **20**. In response, the portable device **20** sets the NP bit in the LCW[LP]. As set forth in the auto-negotiation standard defined by Clause 28 of the D4 draft of the *ANSI/IEEE Std* 802.3 *MAC Parameters, Physical Layer, Medium Attachment Units and Repeater for* 100 *Mb/s Operation*, when the NP bit is set, before communications is initiated using the common communications protocol, additional data is exchanged using the same method for exchanging messages between the docking station **10** and the portable device **20**. The remainder of the activities illustrated in **FIG. 3** comprise the second mode of operation.

[**0038**] In step **256**, a data request message is sent from the portable device **20** to the docking station **10**. The data request message is encoded as the LCW[LP] with the Ack bit set and with the NP bit set. This indicates that the previous communications protocol data from the docking station **10** was received properly by the portable device **20**, and that the portable device **20** is ready to receive additional data. In step **206**, the data request message from the portable device is received at the docking station **10**.

[**0039**] A MAC address contains 48 bits or 6 bytes. An LCW may convey up to 11 bits of additional data. In the illustrated embodiment, the MAC address is communicated from the docking station **10** to the portable device **20** eight bits or one byte at a time. That is, six messages, containing one byte of the MAC address, are sent from the docking station **10** to the portable device **20** to convey the complete MAC address. Table 2 (below) illustrates the structure of the LCW messages carrying the MAC address. Bits D**0** through D**7** carry a byte of the MAC address M**0** through M**7**. Bits D**8** through D**10** carry the number of the MAC address byte N**0** through N**2**. Bytes **1** through **6** carry the corresponding byte of the MAC address and a byte **7** carries a CRC of the MAC address calculated using the polynomial X^7+X^2+1.

TABLE 2

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
M0	M1	M2	M3	M4	M5	M6	M7	N0	N1	N2				Ack	NP

[**0040**] In step **208**, a first LCW[LD] is formatted as illustrated in Table 2 (above) by the interface processor **25** to contain the first byte of the MAC address and the byte number set to "1". Because there will be further messages containing remaining bytes of the MAC address, the NP bit is set in the LCW[LD]. This message is communicated, in the manner described above, to the portable device **20**. The message containing the first byte of the MAC address is received by the portable device **20** in step **258**. The Ethernet controller **33** stores the received byte of the MAC address.

[**0041**] In step **260**, the portable device **20** detects the state of the NP bit in the received LCW[LD]. If the NP bit is set, this indicates that other messages will be forthcoming. In this case, step **256** is repeated. In step **256**, the acknowledgement LCW[LP] sent in response to the LCW[LD] containing the first byte of the MAC address has the Ack bit set, the NP bit set, and the byte number B0 through B3 set to "2", thus forming a data request to receive the next message from the docking station **10** containing byte **2** of the MAC address. In step **210**, the interface processor **25** in the docking station **10** checks whether more bytes of the MAC address remain to be communicated. If so, step **206** is repeated waiting for a data request message from the portable device **20**. When such a data request message is received, step **208** is performed, in which an LCW[LD], containing the requested byte of the MAC address, and with the NP bit set, is composed and sent to the portable device **20**. Steps **206**, **208**, **210** and **256**, **258** and **260** are repeated to transfer the respective bytes of the MAC address and the CRC byte.

[**0042**] If in step **210** it is determined that the last byte of the MAC address parameter, the CRC, is to be communicated to the portable device **20**, step **212** is performed. In step **212** the interface processor **25** in the docking station **10** composes an LCW[LD] containing the CRC byte of the MAC address with the NP bit not set. This indicates that no further data is available for acquisition by the portable device **20**. In step **258**, this message is received and the CRC byte is stored by the Ethernet controller **33**. Because the NP bit was not set in the LCW[LD] received by the portable device **20**, the acknowledgement LCW[LP] has the Ack bit set, but the NP bit unset. Because the NP bit in the LCW[LP] is not set, this is not a data request from the portable device **20**, and indicates that the portable device **20** successfully acquired the full MAC address.

[**0043**] In this case, in step **260**, the state of the NP bit indicates that no further messages are forthcoming, and in step **262** the six bytes of the MAC address are combined to form the MAC address, and that MAC address is stored in the MAC address store **34**. In addition, the CRC received from the docking station **10** is compared to the CRC calculated from the MAC address stored in the address store **34**. In steps **216** and **266**, network communications is established between the portable device **20** and the hospital communications network. In the docking station **10**, step **216** conditions the multiplexer **31** (**FIG. 2**) to couple the Ethernet link to the hospital communications network to either the optical link **17**, **19** or the RF link **103**. In the portable device **20**, the Ethernet controller **33** initiates communications with the hospital communications network via the optical link **21**, **23** or the RF link **107**. As described above, the messages sent from the Ethernet controller **33** of the portable device **20** to the hospital communications network include the MAC address in **34** as the sending node identifier. The destination address of messages received by the Ethernet controller **33** in the portable device **20** from the hospital communications network are compared to the MAC address in **34** to determine if they are addressed to the portable device **20**. If they are, the Ethernet controller **33** processes the received messages.

[**0044**] When communications has been established, it is possible for the portable device **20** to be undocked from the docking station **10**. When this is detected, for example, by detecting a change in voltage on the primary winding of the split transformer **15**, the multiplexer **31** couples the RF communications circuit **103** to the Ethernet link to the hospital communications network and the Ethernet controller **33** in the portable device **20** communicates through the RF communications circuit **107**. Provided the portable device **20** remains within range of the docking station, the communications link between the portable device **20** and the hospital communications network is maintained. If the RF link is lost, the portable device **20** goes into undocked mode, described above.

[**0045**] If the portable device **20** is redocked without losing communications, the load sense circuit **13** may detect that the portable device has been redocked, but the presence of an active communications link to the hospital communications network, and/or the presence of an active communications link between the portable device **20** and the docking station **10** may be detected. Detection of these conditions will inhibit re-establishment of the communications link as described in detail above.

[0046] **FIG. 4** is a block diagram of a computer system on which the portable device configuration system illustrated in **FIG. 1** and **FIG. 2** may be implemented. The processing system **400** includes a central processing unit (CPU) **402**, a memory **404**, a mass storage device **406**, and an input/output (I/O) interface **408** coupled together by a computer bus **405**. The I/O interface **408** is coupled to a user interface consisting of a monitor **415**, a keyboard **412** and a pointing device, which in the illustrated embodiment is a mouse **414**. The I/O interface **408** is also coupled to a removable storage interface **410** capable of retrieving data from or storing data on one or more tangible electronic data storage media **416**. The tangible electronic data storage media **416** may include magnetic devices such as reel-to-reel computer tape, cassette tapes, and magnetic disk media such as floppy disks, and so forth. The tangible electronic data storage media **416** may also include optical devices, such as digital video disks (DVD) or compact disks (CD) and so forth. The tangible electronic data storage media **416** may also include portable storage devices such as semiconductor memory integrated circuits, e.g. memory sticks, and so forth. The I/O interface **408** may also be coupled to other peripheral devices (not shown) such as printers or communications devices for communicating with remote systems, local area networks (LANs) or wide area networks (WANs) such as the internet. One skilled in the art understands that the removable storage interface **410** may be coupled to the I/O interface **408** via a network interface (not shown), which allows the tangible electronic data storage media **416** to be located remote from the processing system **400**.

[0047] In operation, the CPU **402** operates as a processor which executes the machine readable instructions forming an executable application and/or executable procedures. Those machine readable instructions are stored in the memory **404**, which may consist of read-only memory (ROM) and/or read/write memory (RAM). The CPU **402** retrieves the machine readable instructions from the memory **404** and executes them to perform the operations of the system described above.

[0048] In the illustrated embodiment, the I/O processor **408** includes a display processor which, in response to commands from the CPU **402**, generates signals representing a display image and supplies those image representative signals to the monitor **415** which displays the images. For example, in a docking station for a patient monitor, signals representing physiological parameters from a patient may be generated by the display processor. These image representative signals are supplied to the display device **415**, which displays the image representing the physiological parameters. The I/O processor **408** also receives user commands and data from the keyboard **412** and/or mouse **414** and provides that information to the CPU **402**. The CPU **402** responds to the received user commands and data to control the operation of the information acquisition system as described above.

[0049] Data may be retrieved from and stored in the mass storage device **406**. For example, the mass storage device **406** may store data representing the machine readable instructions forming the executable application and/or executable procedures. The CPU **402** may retrieve the executable application and/or executable procedures from the mass storage device **406** and store them in the memory **404**. The CPU **402** may retrieve the machine readable instructions from the memory **404** and execute the executable application and/or executable procedures to perform the activities described above.

[0050] Data may also be retrieved from and stored in tangible electronic data storage media **416** via the removable storage interface **410**, whether local or remotely located. Any data may be stored in and/or retrieved from the tangible electronic data storage media **416**. More specifically, in the illustrated embodiment, the machine readable instructions in the executable application and/or executable procedures forming the system described above may be stored in a tangible electronic data storage medium **416**. The CPU **402** may condition the I/O processor **408** to retrieve the executable application and/or executable procedures from the appropriate tangible electronic data storage medium **416** via the removable storage interface **410**, and to store the executable application and/or executable procedures in the mass storage device **406** and/or the memory **404**. The CPU **402** may execute the executable application and/or executable procedures in the memory **404** to perform the activities described above.

[0051] The portable device configuration system has been described above in a medical environment relating to a portable patient monitor and docking station. However, such a system may find application in any system in which a new device may be added to a communications network intended to operate as a node through a repeater.

What is claimed is:

1. In a system for communicating a parameter from a first device to a second device, an interface processor comprising circuitry for:

communicating to said second device first message data identifying a communication protocol to be used in communicating with said first device and indicating additional data is available for acquisition;

receiving from said second device one or more data request messages initiated in response to data received from said first device indicating that additional data is available for acquisition;

communicating said parameter to said second device in one or more separate messages in response to said one or more corresponding data request messages from said second device;

receiving data indicating said parameter has been acquired by said second device; and

in response to receiving data indicating said parameter has been acquired by said second device, updating message data for communication to said second device to indicate additional data is unavailable for acquisition.

2. A system according to claim 1 further comprising circuitry for initiating communications between said first and second devices using said identified communications protocol after said parameter has been communicated from said first device to said second device.

3. A system for communicating a parameter from a first device to a second device, comprising:

an input processor for receiving data indicating a first device electronic address;

an interface processor used by said first device for:

communicating to said second device, first message data identifying a communication protocol to be used in communicating with said first device and indicating additional data is available for acquisition,

communicating said electronic address to said second device in one or more separate messages in response to one or more corresponding data request messages from said second device, said data request messages being initiated in response to data received from said first device indicating additional data is available for acquisition; and

in response to receiving data indicating said first device electronic address has been acquired by said second device, updating message data for communication to said second device to indicate additional data is unavailable for acquisition.

4. A system according to claim 3 wherein the interface processor initiates communications between said first and second devices using said identified communications protocol after said first device electronic address has been communicated from said first device to said second device.

5. A system according to claim 3 wherein:

said first device is a docking station suitable for attaching to a portable patient monitoring device;

said second device is a portable patient monitoring device; and

said interface processor communicates said electronic address from said docking station to said portable patient monitoring device using an Ethernet compatible auto-negotiation procedure.

6. A system according to claim 3 wherein said electronic address is an Ethernet compatible MAC address.

7. A system for use in a docking station suitable for attaching to a portable processing device, said portable processing device being for processing signal parameters, comprising:

a power coupler for coupling power to provide electrical power to a portable processing device; and

an interface processor for:

in a first mode of operation, communicating an identifier associated with a particular docking station to said portable processing device using an Ethernet compatible auto-negotiation procedure, and

in a second mode of operation, establishing connection of said portable processing device to a network.

8. A system according to claim 7 including a controller for detecting a portable processing device is attached to said docking station and for initiating said first mode of operation and for subsequently initiating said second mode of operation.

9. A system according to claim 7 wherein said controller detects said portable processing device is attached to said docking station by detecting at least one of, (a) an active communication link to said network is present, (b) an active communication link is present between said docking station and said portable processing device and (c) a portable patient monitoring device is docked with said docking station and receiving electrical power from said docking station.

10. A system according to claim 7 further comprising a controller for inhibiting said first mode of operation until said controller determines said portable processing device is attached to said docking station and is powered on.

11. A system according to claim 7 wherein said interface processor supports communication using wireless technologies including at least one of, (a) WLAN 802.11b standard compatible communication, (b) 802.3 standard compatible communication, (c) 802.11 standard compatible communication, (d) Bluetooth 802.15 standard compatible communication, and (e) GSM/GPRS standard compatible communication.

12. A system for use in docking station suitable for being attached to a portable patient monitoring device for monitoring and processing signal parameters acquired from a patient, comprising:

an communication interface employed by a docking station, for:

communicating to said portable patient monitoring device, first message data identifying a communication protocol to be used in communicating with said docking station and indicating additional data is available for acquisition,

communicating an electronic address associated with said docking station to said portable patient monitoring device in one or more separate messages in response to one or more corresponding data request messages from said portable patient monitoring device, said data request messages being initiated in response to data received from said docking station indicating additional data is available for acquisition, and

in response to receiving data indicating said docking station electronic address has been acquired by said portable patient monitoring device, communicating a message indicating address data communication is complete.

13. A system according to claim 12 wherein said communication interface communicates said electronic address to said portable patient monitoring device during bidirectional configuration data exchange in response to insertion of said portable patient monitoring device in said docking station.

14. A system according to claim 13 wherein said communication interface communicates said electronic address to said portable patient monitoring device during bidirectional configuration data exchange in response to a first insertion of said portable patient monitoring device in said docking station.

15. A method for communicating a parameter from a first device to a second device, comprising the activities of:

receiving data indicating a first device electronic address;

communicating to said second device, first message data identifying a communication protocol to be used in communicating with said first device and indicating additional data is available for acquisition;

communicating said electronic address to said second device in one or more separate messages in response to one or more corresponding data request messages from said second device, said data request messages being initiated in response to data received from said first device indicating additional data is available for acquisition; and

in response to receiving data indicating said first device electronic address has been acquired by said second device, updating message data for communication to said second device to indicate additional data is unavailable for acquisition.

16. A tangible storage medium incorporating machine readable instructions for performing the activities of claim 15.

17. A system for use in a portable patient monitoring device for monitoring and processing signal parameters acquired from a patient and being suitable for being attached to a docking station, comprising:

an interface processor employed by a portable patient monitoring device for:

receiving first message data identifying a communication protocol to be used in communicating with a docking station, said first message data indicating additional data is available for acquisition,

communicating one or more data request messages to said docking station and receiving from said docking station an electronic address associated with said docking station in one or more separate response messages in response to data received from said docking station indicating additional data is available for acquisition, and

in response to receiving an electronic address, communicating a message to said docking station indicating address data communication is complete.

18. A system according to claim 17 further comprising:

a data acquisition processor for receiving and processing patient parameter data from a plurality of different patient attached sensors to provide processed patient parameter data; and

an display device for displaying processed patient parameter data.

19. A system according to claim 17 wherein said communication interface communicates processed patient parameter data to said docking station when said portable patient monitoring device is attached to said docking station, said processed patient parameter data comprising physiological data including at least one of, (a) electrocardiograph (ECG) data, (b) blood parameter data, (c) ventilation parameter data, (d) infusion pump related data, (e) blood pressure data, (f) pulse rate data and (g) temperature data.

20. A system according to claim 17 wherein said electronic address associated with said particular docking station enables determination of a geographic location of said particular docking station from a map associating said identifier with a corresponding geographic location.

21. A system according to claim 17 wherein said electronic address associated with said particular docking station comprises at least one of, (a) an Ethernet compatible MAC address, (b) an IP address, (c) a port identifier, (d) an Internet compatible address, and (e) a LAN address.

22. A system according to claim 17 wherein said interface processor communicates by at least one of (a) wireless and (b) wired communication.

* * * * *