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(54) **SYSTEM AND METHOD FOR USER INTERACTION WITH MEDICAL EQUIPMENT**

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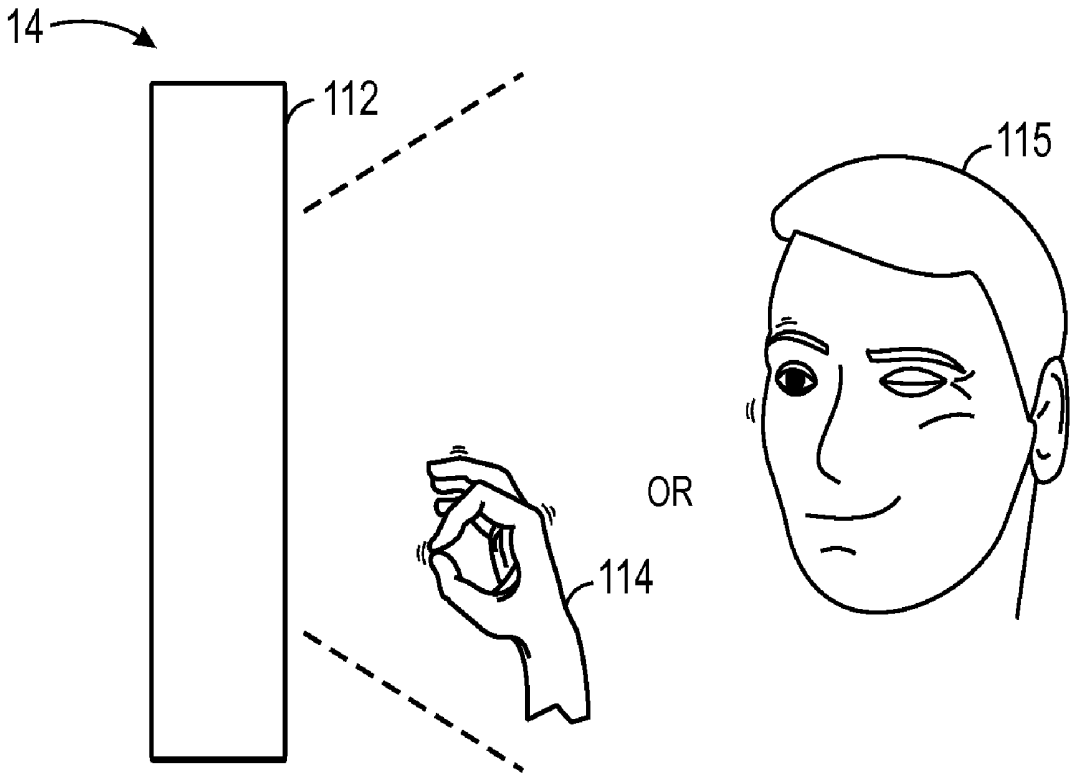
(57) **ABSTRACT**

According to various embodiments, a system may include a user interface configured to detect a first gesture that identifies a specific user. The system may also include a patient monitoring system coupled to user interface that is configured to monitor at least one physiological parameter of a patient. The patient monitoring system may be configured to retrieve and to display one or more event markers for the specific user in response to the detected first gesture. The one or more event markers represent steps of a procedure performed on the patient, and each event marker of the one or more event markers is associated with a respective reimbursement code. The system may convey user identification information associated with the specific user and selected event markers for automatic billing and reimbursement for approved medical procedures.



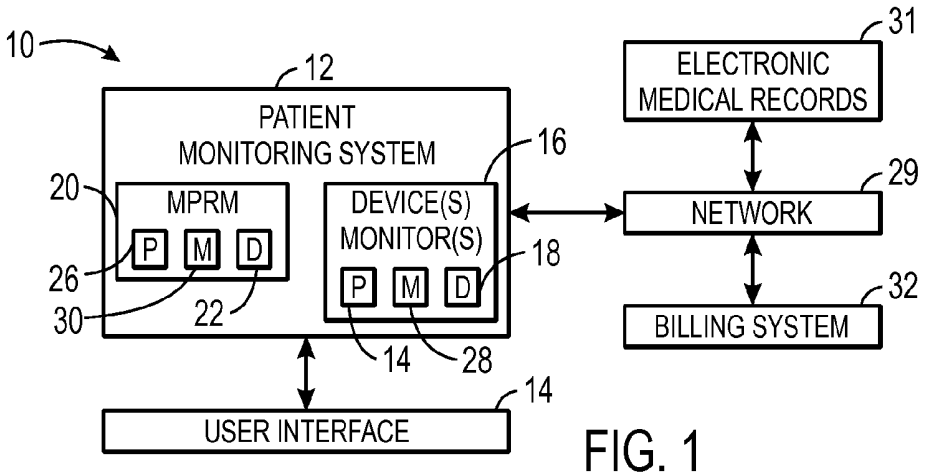

10
12
PATIENT MONITORING SYSTEM
20
MPRM
P
M
D
26
30
22
DEVICE(S) MONITOR(S)
16
18
P
M
D
14
28
USER INTERFACE
14
ELECTRONIC MEDICAL RECORDS
31
NETWORK
29
BILLING SYSTEM
32

FIG. 1

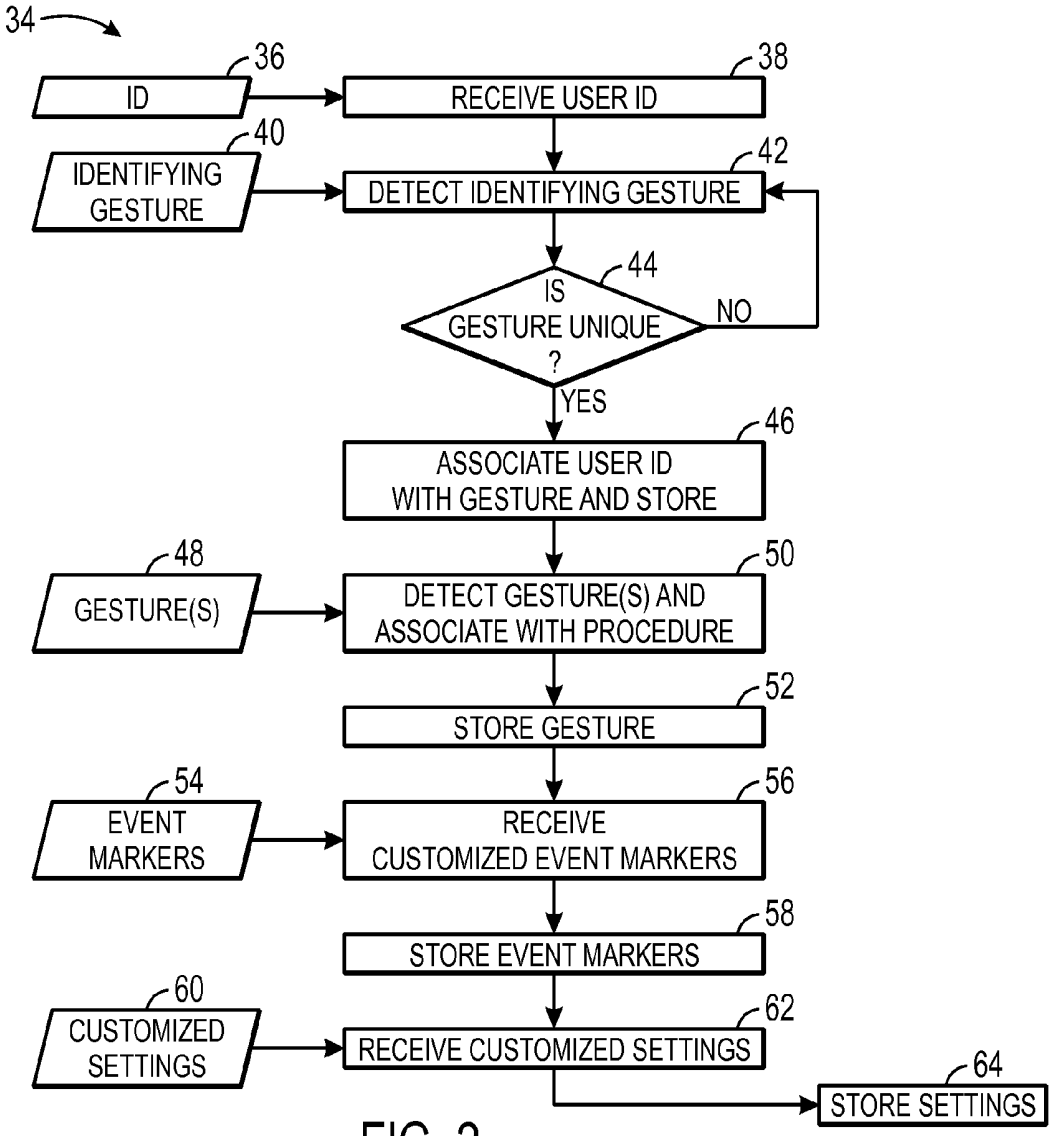

34
ID
36
RECEIVE USER ID
38
IDENTIFYING GESTURE
40
DETECT IDENTIFYING GESTURE
42
IS GESTURE UNIQUE ?
44
NO
YES
ASSOCIATE USER ID WITH GESTURE AND STORE
46
GESTURE(S)
48
DETECT GESTURE(S) AND ASSOCIATE WITH PROCEDURE
50
STORE GESTURE
52
EVENT MARKERS
54
RECEIVE CUSTOMIZED EVENT MARKERS
56
STORE EVENT MARKERS
58
CUSTOMIZED SETTINGS
60
RECEIVE CUSTOMIZED SETTINGS
62
STORE SETTINGS
64

FIG. 2

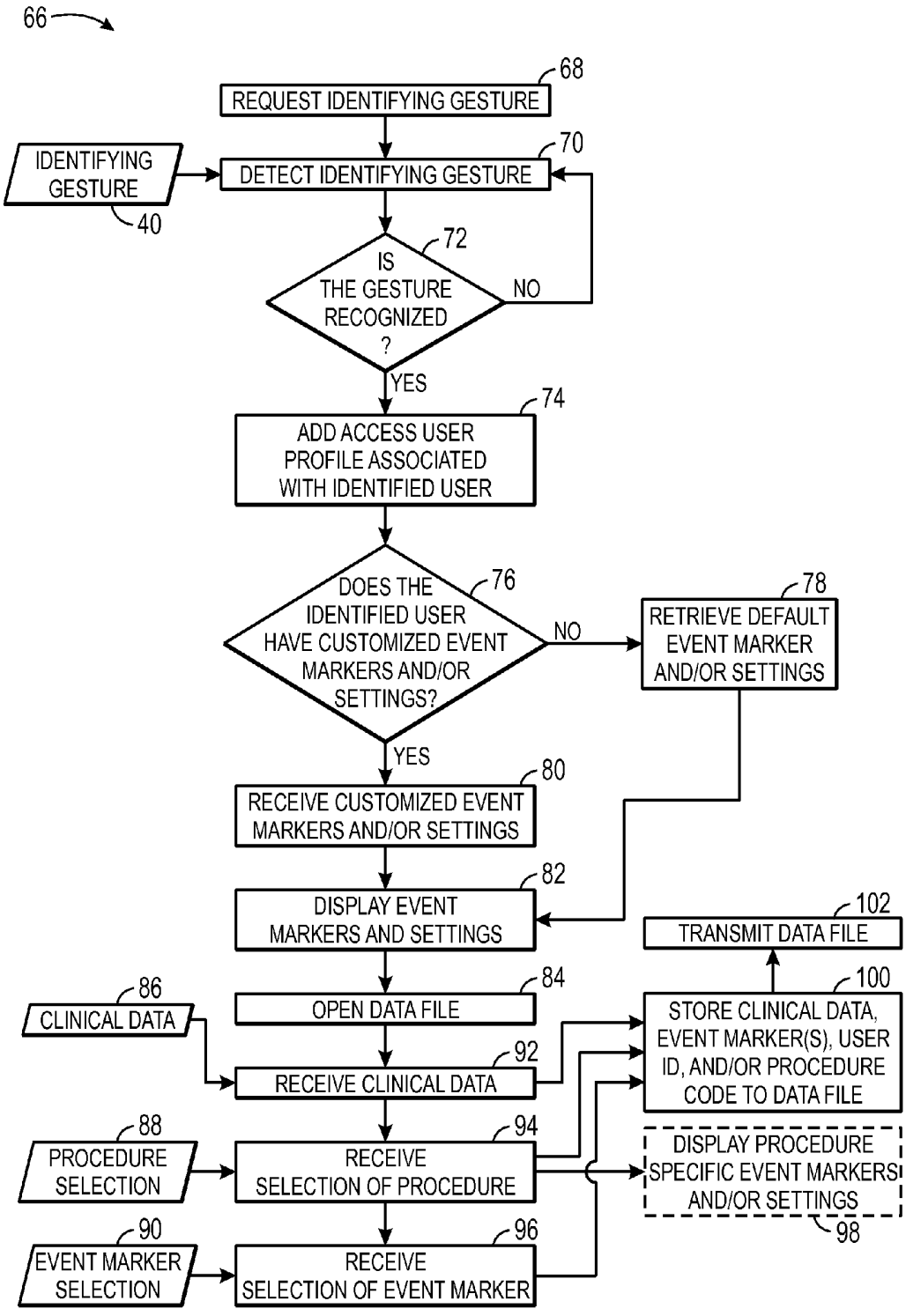

66
68
REQUEST IDENTIFYING GESTURE
IDENTIFYING GESTURE
40
70
DETECT IDENTIFYING GESTURE
72
IS THE GESTURE RECOGNIZED ?
NO
YES
74
ADD ACCESS USER PROFILE ASSOCIATED WITH IDENTIFIED USER
DOES THE IDENTIFIED USER HAVE CUSTOMIZED EVENT MARKERS AND/OR SETTINGS?
76
NO
78
RETRIEVE DEFAULT EVENT MARKER AND/OR SETTINGS
YES
80
RECEIVE CUSTOMIZED EVENT MARKERS AND/OR SETTINGS
82
DISPLAY EVENT MARKERS AND SETTINGS
102
TRANSMIT DATA FILE
86
CLINICAL DATA
84
OPEN DATA FILE
100
STORE CLINICAL DATA, EVENT MARKER(S), USER ID, AND/OR PROCEDURE CODE TO DATA FILE
92
RECEIVE CLINICAL DATA
88
PROCEDURE SELECTION
94
RECEIVE SELECTION OF PROCEDURE
DISPLAY PROCEDURE SPECIFIC EVENT MARKERS AND/OR SETTINGS
98
90
EVENT MARKER SELECTION
96
RECEIVE SELECTION OF EVENT MARKER

FIG. 3

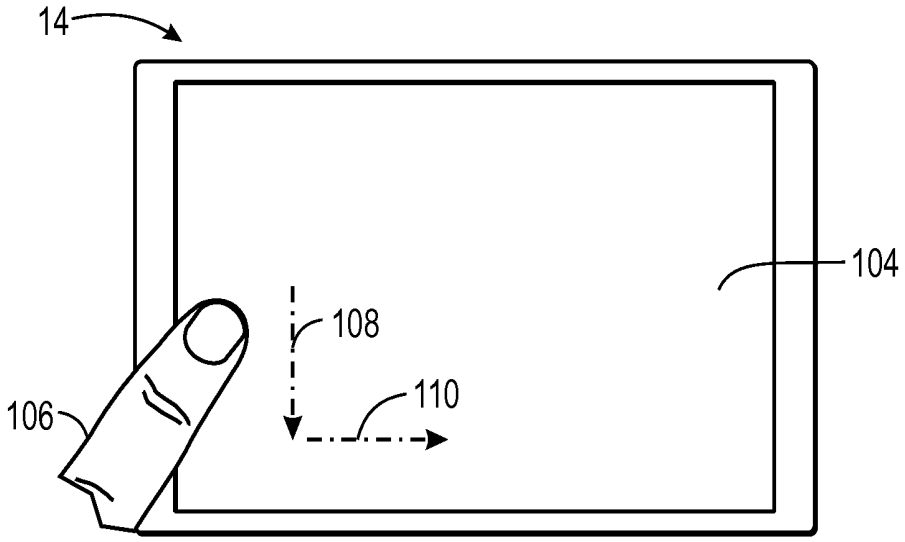


FIG. 4

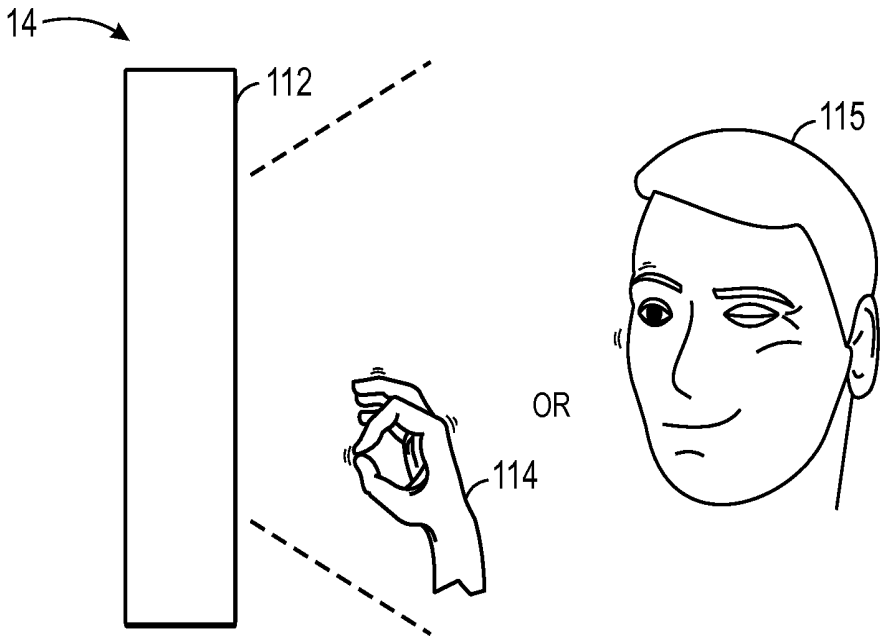


FIG. 5

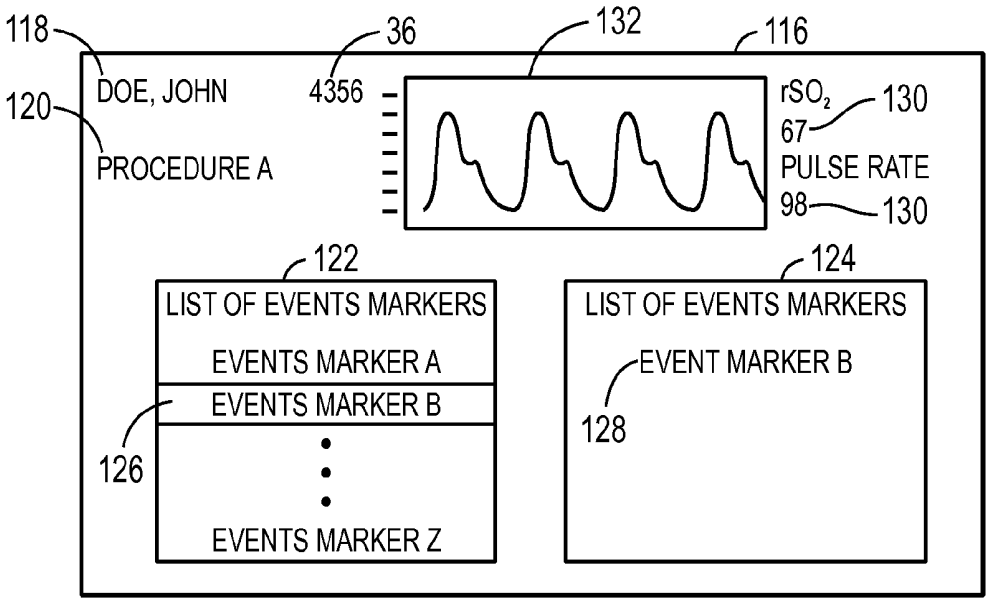

118
36
132
116
DOE, JOHN
4356
120
PROCEDURE A
rSO2
130
67
PULSE RATE
98
130
122
124
LIST OF EVENTS MARKERS
EVENTS MARKER A
EVENTS MARKER B
126
EVENTS MARKER Z
LIST OF EVENTS MARKERS
EVENT MARKER B
128

FIG. 6

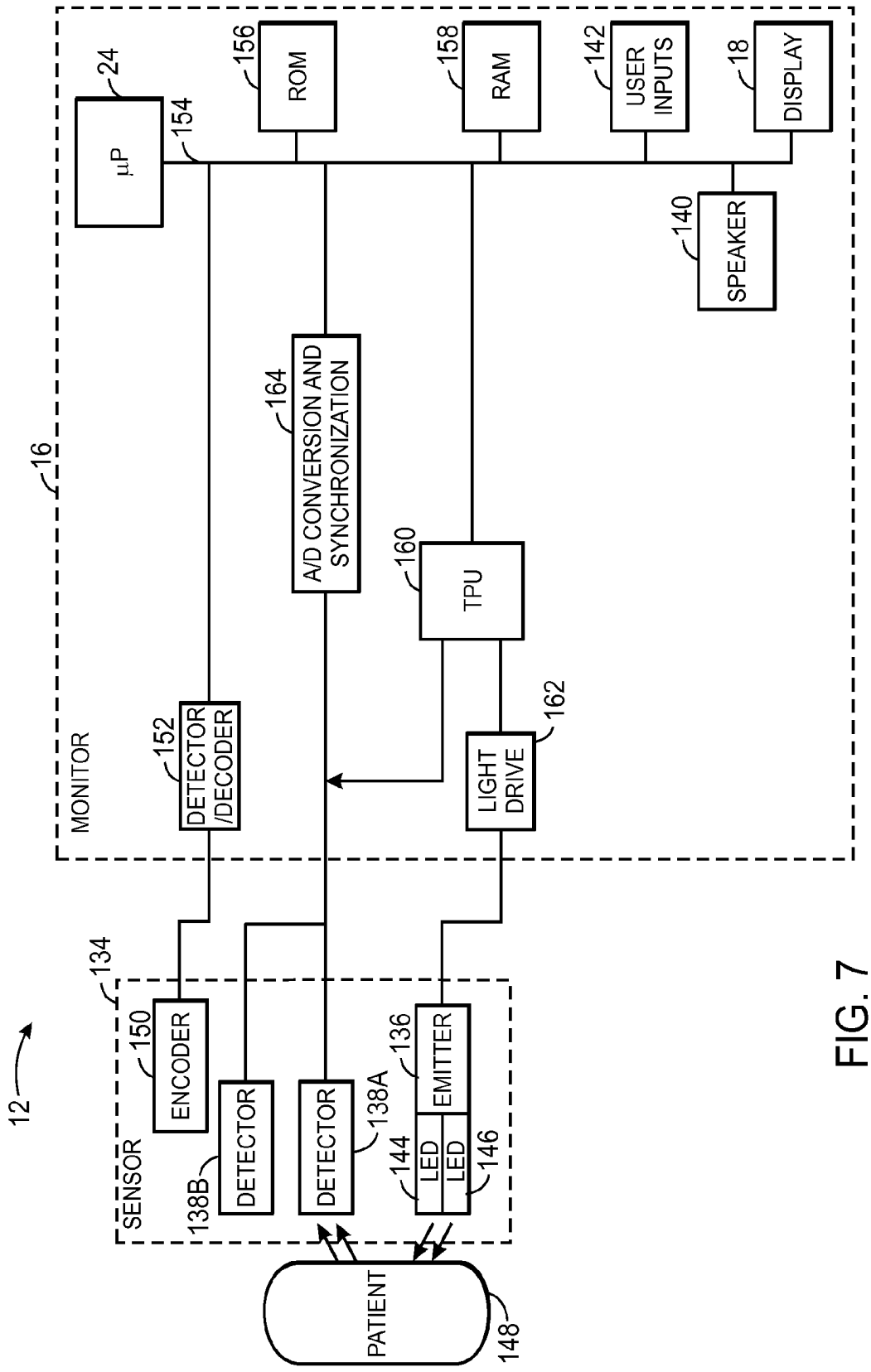

12
16
MONITOR
24
μP
154
156
ROM
158
RAM
142
USER INPUTS
18
DISPLAY
140
SPEAKER
164
A/D CONVERSION AND SYNCHRONIZATION
160
TPU
152
DETECTOR /DECODER
162
LIGHT DRIVE
134
SENSOR
150
ENCODER
138B
DETECTOR
DETECTOR
138A
136
EMITTER
144
LED
LED
146
PATIENT
148

FIG. 7

SYSTEM AND METHOD FOR USER INTERACTION WITH MEDICAL EQUIPMENT

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and the benefit of Provisional Application No. 61/924,014, entitled "SYSTEM AND METHOD FOR USER INTERACTION WITH MEDICAL EQUIPMENT", filed Jan. 6, 2014, which is herein incorporated by reference in its entirety.

BACKGROUND

[0002] The present disclosure relates generally to medical equipment and, more particularly, to user interfaces that enable the identification and/or selection of information associated with the use of the medical equipment.

[0003] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present disclosure, which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

[0004] An end-user (e.g., clinician or health care provider) utilizing medical equipment (e.g., administration of a particular protocol) may define event markers. These event markers indicate important interventions or steps during a medical procedure. For example, a cardiac procedure (e.g., bypass) may include a variety of steps such as endotracheal intubation, inducing hypothermia, clamping arteries, replacing valves, and/or recovery. Also, these event markers may be linked to reimbursement codes that enable health care providers to charge for specific interventions or events. As a result, making event markers readily available to a health care provider may have important economic consequences. However, different users and different procedures require different event markers. Typically, a large number of event markers are created making it difficult for the user to locate and select the correct marker during a procedure. Often times, the desired event marker may be buried among multiple markers, making selection of a marker a frustrating experience for the user, and, in some cases, preventing the use of the event markers, which may diminish the economic value of utilizing event markers in seeking reimbursement, thus reducing the value of the medical monitoring system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Advantages of the disclosed techniques may become apparent upon reading the following detailed description and upon reference to the drawings in which:

[0006] FIG. **1** is a block diagram of a system configured to enable user interaction with a patient monitoring system;

[0007] FIG. **2** is a process flow diagram of an embodiment of a method for customizing user interaction with the system of FIG. **1**;

[0008] FIG. **3** is a process flow diagram of an embodiment of a method for using the system of FIG. **1**;

[0009] FIG. **4** is diagrammatical view of an embodiment of a user interface (e.g., touchscreen);

[0010] FIG. **5** is a diagrammatical view of an embodiment of a user interface (e.g., touch-free gesture recognition user interface);

[0011] FIG. **6** is a representation of an embodiment of a screen of a monitor and/or user interface; and

[0012] FIG. **7** is a block diagram of an embodiment of a medical device or monitor that may be included in the patient monitoring system of FIG. **1**.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0013] One or more specific embodiments of the present techniques will be described below. In an effort to provide a concise description of these embodiments, not all features of an actual implementation are described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0014] When introducing elements of various embodiments of the present disclosure, the articles "a," "an," and "the" are intended to mean that there are one or more of the elements. The terms "comprising," "including," and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements. Additionally, it should be understood that references to "one embodiment" or "an embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Also, as used herein, the term "over" or "above" refers to a component location on a sensor that is closer to patient tissue when the sensor is applied to the patient.

[0015] The present embodiments relate to a system that facilitates user interaction with a patient monitoring system and associated medical devices. For example, the system may include a user interface (e.g., touchscreen or touch-free gesture recognition user interface) that facilitates the identification of a specific user, identification and/or selection of specific procedures (e.g., coronary bypass artery surgery or graft or any other procedure), and/or the identification and/or selection of specific event markers (e.g., potential steps to be performed during a procedure) associated with a specific procedure and/or user. The user interface may be coupled to one or more medical devices of the patient monitoring system or integrated within one or more of the medical devices. The user interface may recognize or detect specific gestures that enable the identification and/or selection of the user, procedure, and other information. Once identified, the patient monitoring system may retrieve and display event markers and/or settings (e.g., patient monitoring or medical device settings such as display settings, alarm thresholds, etc.) for the identified user. Also, the patient monitoring system may retrieve and display event markers and/or settings for an identified or selected procedure. The patient monitoring system may associate into a single file values for one or more physiological parameters obtained from the patient undergoing the procedure, user identification information (e.g., user code or

ID) associated with the specific user, a procedure code identifying the selected procedure performed on the patient, and/or any event markers selected by the specific user during the procedure. The procedure code and/or event markers may be linked to reimbursement codes that enable health care providers to charge for specific interventions. This system may make it easier and more intuitive for users to identify themselves and to personalize settings when using medical equipment. In addition, the ability to customize with the system facilitates reimbursement by encouraging the use of the event markers.

[0016] With this in mind, FIG. **1** depicts an embodiment of a system **10** that facilitates user interaction with a patient monitoring system **12** via a user interface **14**. The user interface **14** may detect gestures that identify a specific user (e.g., clinician or health care provider). In addition, the detected gestures may be used to identify or select a procedure (e.g., coronary bypass artery surgery or graft or any other procedure) to be performed or being performed on a patient. Further, the detected gestures may be used to identify or select event markers (e.g., potential steps to be performed during a procedure) specific to a procedure and/or user. The user interface **14** may include a touchscreen, touch-free gesture recognition user interface, or a combination thereof. In embodiments where the user interface **14** includes a touchscreen, a detected gesture (e.g., touch or contact based gesture) may include a sequence of touches created by dragging one or more fingers on the touchscreen. In embodiments where the user interface **14** includes a touch-free gesture recognition user interface, the interface **14** may recognize a position and/or movement of one or more fingers and/or the hand.

[0017] The patient monitoring system **12** may include one or more medical devices or monitors **16** (e.g., pulse oximeter, regional oximeter, blood pressure device, ventilator, etc.) that may each be configured to monitor one or more physiological parameters (e.g., oxygen saturation, regional oxygen saturation, pulse rate, blood pressure, etc.). The user interface **14** interface may be separate from and coupled to the patient monitoring system **12** (e.g., one or more of the medical devices or monitors **16**). In certain embodiments, the patient monitor **16** may be part of or integral to one or more of the medical devices or monitors **16**. In embodiments, where the user interface **14** includes a touchscreen, the touchscreen may be part of a respective display **18** of the one or more devices or monitors **16**.

[0018] One or more of these devices or monitors **16** may be coupled to one or more sensors (e.g., via a wired or wireless connection) (see FIG. **7**). The sensors may generate one or more signals and the monitors **16** may calculate and display (e.g., via a respective display **18**) one or more physiological parameters from one or more signals received from the sensors, information about the system, and/or alarm indications. In certain embodiments, one or more of the devices or monitors **16** may be coupled to a multi-parameter patient monitor **20** (e.g., via a wired or wireless connection). The multi-parameter patient monitor **20** may be configured to calculate one or more physiological parameters and to provide a central display **22** for the visualization of information from one or more of the devices or monitors **16**. The monitors or devices **16** and/or multi-parameter patient monitor **20** may include various input components knobs, switches, keys and keypads, buttons, touchscreen, scanner, etc., to provide for operation and configuration of the monitors **16**, **20**. Each device **16** and/or multi-parameter monitor **20** may include one or more respective processors **24**, **26** configured to execute code stored on respective memories **28**, **30** to calculate the one or more physiological parameters. The processors **24**, **26** may also execute code that may utilize the detected gestures to identify a specific user, to select or identify specific procedures, and/or to select specific event markers (i.e., potential steps of a procedure to be performed on a patient). Further, the processors **24**, **26** may retrieve and cause to be displayed (e.g., on displays **16**, **18**) event markers and/or settings (e.g., patient monitoring or medical device settings such as display settings, alarm thresholds, etc.) for the identified user and/or for an identified or selected procedure. The processors **24**, **26** may associate into a single file values for one or more physiological parameters obtained from the patient undergoing the procedure, user identification information (e.g., user code or ID) associated with the specific user, a procedure code identifying the selected procedure performed on the patient, and/or any event markers selected by the specific user during the procedure. This file may be stored on the respective memories **28** of the devices or monitors **16** or transferred (e.g., via a wired or wireless connection) to the multi-parameter patient monitor **20**. Also, the file may be stored on a removable storage medium (e.g., flash memory, USB flash drive, etc.). In certain embodiments, the devices or monitors **16** and/or the multi-parameter patient monitor **20** may be connected to other systems via a network **29**. The devices or monitors **16** and/or multi-parameter patient monitor **20** may be coupled to the network **29** via a physical (e.g., wired or cabled) connection or via a wireless communication technology, such as Wi-Fi, WiMax, Bluetooth, or the like. The network **29** may include one or more servers, which may be configured to facilitate the exchange of information between devices or monitors **16** and/or multi-parameter patient monitor **20**. For example, the patient monitoring system **12** may be coupled to an electronic medical records database **31** and/or a billing system **32** via the network **29**. The patient monitoring system **12** may transfer the files (including values for one or more physiological parameters obtained from the patient undergoing the procedure, user identification information associated with the specific user, a procedure code identifying the selected procedure performed on the patient, and/or any event markers selected by the specific user during the procedure) to the electronic medical records **31** for storage and/or the billing system **32** to determine reimbursement for the healthcare provider (e.g., via automatic billing for approved medical procedures). The procedure code and/or event markers within each file may be linked to reimbursement codes that enable health care providers to charge for specific interventions.

[0019] As discussed above, the system **10** facilitates user interaction with the patient monitoring system **12** via the user interface **14** to make it easier and more intuitive for users to identify themselves and to personalize settings when using medical equipment (e.g., devices or monitors **16**). FIG. **2** illustrates a method **34** for how a user interacts with the system **10** to customize it for their use during a medical procedure. The method **34** may begin with the system **10** (e.g., devices or monitors **16**) receiving a user ID **36** (e.g., user code and/or other user identification information) (block **38**). The user ID **36** may be inputted via input components located on the devices or monitors **16** and/or the user interface **14**. In certain embodiments, the user interface **14** may be part of (e.g., makeup part of the user inputs) one or more of the devices or monitors **16**. In certain embodiments, the user ID **36** may be entered, for example, using a barcode reader or an

RFID tag. After receiving the user ID **36**, the user interface **14** may detect an identifying gesture **40** of the user (block **42**). For example, the user interface **14** may include a touchscreen that detects various touches or sequence of touches by the user that represent the identifying gesture **40**. In some embodiments, the user interface **14** may include a touch-free gesture recognition interface that can recognize a position and/or movement of one or more fingers and/or the hand (i.e., gesture). Upon detecting the identifying gesture **40**, the patient monitoring system **12** (e.g., processors **24**, **26**) may determine whether the identifying gesture **40** was unique relative to other gestures stored on the system **12** (block **44**). If the gesture **40** was not unique, the patient monitoring system **12** (e.g., interface **14** and/or monitors **16**, **20**) may indicate to the user that the gesture **40** was not unique and/or to provide a different identifying gesture **40** for determining its uniqueness. If the gesture **40** is unique, the patient monitoring system **12** may associate or link the gesture **40** with the user ID **36** of the user and store both the user ID and the identifying gesture **40** (e.g., on memories **28**, **30**).

[0020] After associating the identifying gesture **40** with the user ID **36** for the user, the patient monitoring system **12** may receive further gestures **48** from the user via the user interface **14** that may be associated or linked with specific procedures (e.g., procedure codes) (block **50**). In certain embodiments, the further gestures **48** may be associated or linked with specific event markers. The gestures **48** (and associated procedure codes) may be stored (e.g., on memories **28**, **30**) by the patient monitoring system **12** in association with the specific user (block **52**). The patient monitoring system **12** may further receive specific customized event markers **54** from the user to be associated with the specific user and/or specific procedure (block **56**). The event markers **54** may be inputted by the user via the input components of the monitors **18**, **20** and/or selected from a list of potential event markers **54** provided to the user by the monitors **18**, **20**. The customized event markers **56** may then be stored (e.g., on memories **28**, **30**) in association with the specific user and/or specific procedure (block **58**). The patient monitoring system **12** may further receive customized settings **60** (i.e., user preferred settings) from the user (block **62**). The settings **60** may include how different values of one or more of the physiological parameters are displayed (e.g., on displays **18**, **22**), an order of display for the physiological parameters, one or more alarm thresholds for one or more of the physiological parameters, what indices and ratios to calculate and display, and other settings. The user may provide different settings for different procedures. The customized settings **60** may then be stored (e.g., on memories **28**, **30**) in association with the specific user and/or specific procedure (block **64**).

[0021] FIG. **3** illustrates a method **66** for how a user interacts with the system **10** during a medical procedure. The method **66** may begin with the patient monitoring system **12** (e.g., monitors **16**, **20** or the user interface **14**) requesting the identifying gesture **40** for the user (block **68**). The user interface **14** may detect the identifying gesture **40** provided by the user (block **70**). As mentioned above, the user interface **14** may include a touchscreen that detects various touches or sequence of touches (e.g., touch or contact based gesture) by the user that represent the identifying gesture **40** and/or other gestures **48**. In some embodiments, the user interface **14** may include a touch-free gesture recognition interface that can recognize a position and/or movement of one or more fingers and/or the hand (i.e., gesture). Upon detecting the identifying gesture **40**, the patient monitoring system **12** (e.g., processors **24**, **26**) may determine whether the identifying gesture **40** is recognized (block **72**). If the gesture **40** is not recognized, the patient monitoring system **12** (e.g., interface **14** and/or monitors **16**, **20**) may indicate to the user that the gesture **40** was not recognized and/or to provide the identifying gesture **40** again for determining. If the gesture **40** is recognized, the patient monitoring system **12** may access the user profiling (including user ID **36**) associated or linked with the gesture **40** (e.g., stored on memories **28**, **30**) (block **74**). In addition, the patient monitoring system **12** (e.g., processors **24**, **26**) may determine if the identified user has any customized event markers **54** and/or settings **60** associated with the user profile (e.g., stored on memories **28**, **30**) (block **76**). If the identified user does not have any customized event markers **54** and/or settings **60**, the patient monitoring system **12** may retrieve default event markers and/or settings (e.g., stored on memories **28**, **30**) (block **78**). If the identified user does have customized event markers **54** and/or settings **60**, the patient monitoring system **12** may retrieve the event markers **54** and/or settings **60** (block **80**). Upon retrieving the event markers and/or settings (default and/or customized), the patient monitoring system **12** may display them on the user interface **14** and/or displays **18**, **22** (block **82**).

[0022] Prior to, subsequent to, and/or concurrent with retrieving the event markers and/or settings, the patient monitoring system **12** may open a data file (block **84**) to associate or store together clinical data **86** (e.g., values of one or more physiological parameters gathered or collected from the patient during a procedure), procedure selections **88** (and associated procedure codes), event marker selections **90**, and/or user identification information associated with the identified user (e.g., user ID **36**). Upon opening the data file, the patient monitoring system **12** may receive clinical data **86** (e.g., oxygen saturation values, regional saturation values, pulse rate, blood pressure, etc.) gathered from the patient (block **92**). In addition, patient monitoring system **12** may receive the selection of one or more procedures **88** from the user (block **94**). In certain embodiments, the selection of the procedure **88** may be inputted by the user via input components of the monitors **16**, **20**. In other embodiments, the selection of the procedure **88** may be made via a gesture detected by the user interface **14**. For example, a unique gesture may be made by the user that when detected by the user interface **14** results in the identification or selection of a specific procedure. Alternatively, the user may use a generic gesture that enables scrolling through a list of procedures and then use a subsequent generic gesture that enables the selection of a specific procedure from the list. In certain embodiments, the specific event markers for a user may overlap one or more event markers associated with a specific procedure. Further, the patient monitoring system **12** may receive the selection of one or more event markers **90** from the user (block **96**). In certain embodiments, the selection of the event marker **90** may be inputted by the user via input components of the monitors **16**, **20**. In other embodiments, the selection of the event marker **90** may be made via a gesture detected by the user interface **14**. For example, the user may use a generic gesture that enables scrolling through a list of event markers (e.g., specific to the user and/or selected procedure) and then use a subsequent generic gesture that enables the selection of a specific procedure from the list. In certain embodiments the user may use a generic gesture that identifies a specific event marker.

[0023] In certain embodiments, the method **66** further includes displaying procedure specific event markers and/or settings based on the selected procedure (block **98**). This may be in conjunction with display of user specific event markers and/or settings or in lieu of. The method **66** may also include storing the received clinical data, any selected event marker (s), user ID **36**, and/or procedure code for a selected procedure to the single data file (block **100**). The single data file may be stored or saved on the memory **28** of the respective device or monitor **16**. Also, the file may be stored on a removable storage medium (e.g., flash memory, USB flash drive, etc.). The file may also be transferred (e.g., via a wired or wireless connection) to the multi-parameter patient monitor **20** (block **102**) for storage on the memory **30**. In addition, the file may be transferred to the electronic medical records database **31** and/or the billing system **32**, via the network **29**, from the monitors **16**, **20**. Utilization of the system **10** via these methods **34**, **66** may make it easier and more intuitive for users to identify themselves and to personalize settings when using medical equipment. In addition, the ability to customize with the system **10** facilitates reimbursement by encouraging the use of the event markers.

[0024] As discussed above, the system **10** includes the user interface **14**. FIGS. **4** and **5** illustrate different types of user interfaces **14** and user interaction with them. For example, in FIG. **4** the user interface **14** includes a touchscreen **104** that detects gestures from the user on the touchscreen **104**. The gestures may include simple or multi-touch gestures. For example, the touchscreen **104** may detect a gesture from one or more fingers or a stylus **106**. The touchscreen **104** may also detect gestures from gloved fingers. The gesture detected by the touchscreen **104** may include one or more movements of any type. The gesture may include movement in one or more directions, including movement of multiple fingers. The gesture, as depicted in FIG. **4**, may be as simple as movement in a first direction **108**, followed by movement in a second direction **110**. The gesture may include any pattern (e.g., circle, square, triangle, X-pattern, etc.). The gesture may also involve a single touch or multiple touches of the touchscreen **104** by the user, using a single or multiple fingers.

[0025] Alternative to or in conjunction with the touchscreen **104**, the user interface **14** may include a touch-free gesture recognition user interface **112** as depicted in FIG. **5**. The interface **112** may recognize a position and/or movement of one or more fingers and/or the hand **114** of the user without the user touching the interface **112**. The interface **112** may also recognize motion or movement of the face **115** (e.g., mouth or lips of the user). The interface **112** may utilize computer vision and/or image processing techniques (e.g., hardware and/or software) to recognize or detect the gesture by the user. Input devices for the interface **112** may include a single standard 2-D camera, stereo cameras, depth-aware cameras, wired gloves, microphones, and/or any other input device that may be used with the interface **112**. Various algorithms to interpret the gestures may include 3-D model based algorithms, skeletal-based algorithms, appearance-based algorithms, or any other type of algorithm to interpret the gesture. FIG. **6** illustrates an example of a screen **116** that may be displayed on the user interface **14** and/or the displays **18**, **22** of the monitors **16**, **20**. It should be noted be noted that some or all of the depicted features on the screen **116** may be shown in other embodiments. Other embodiments of the screen **116** may include additional features not shown (e.g., reimbursement codes, additional physiological parameters, thresholds, alarms, trend data, etc.). The name of the user **118** (e.g., clinician, health care provider, etc.) may be shown as well as the user ID **36** on the screen **116**. In certain embodiments, information (e.g., name, patient ID, etc.) that identifies a patient undergoing the procedure may be shown. A procedure **120** selected by the user may also be shown. In addition, a list of event markers **122** may be shown on the screen **116**. The list of event markers **122** may be specific to the user and/or procedure **120**. In addition, a list of selected event markers may be shown on the screen **116**. As illustrated, the user may scroll through the list of event markers **122**, as described above, to select a desired event marker. For example, the event marker to be selected (e.g., Event Marker B) may highlighted as indicated by numeral **126** and appear among the list of selected event markers **124** as indicated by numeral **128**. The list of selected event markers **124** may include one or more selected event markers.

[0026] In addition, the screen **116** may also display one or more values **130** for one or more physiological parameters (e.g., regional oxygen saturation, oxygen saturation, pulse rate, blood pressure, hydration level, etc.). In addition, graphs and/or waveforms **132** related to the physiological parameters may be shown on the screen **116**. In certain embodiments, other information related to the physiological parameters may be shown. For example, trend data, alarm thresholds, alarms, and other information may be displayed on the screen **116**. The physiological parameters and related information may be shown according to the specific settings for the user and/or the procedure.

[0027] As described above, one or more medical device or monitors **16** may used in the patient monitoring system **12**. FIG. **7** depicts an embodiment of a medical monitor **16** that may be used in conjunction with a medical sensor **134**. Although the depicted embodiments relate to sensors for use on a patient's head, it should be understood that, in certain embodiments, the features of the sensor **134** as provided herein may be incorporated into sensors for use on other tissue locations, such as the back, the stomach, the heel, the ear, an arm, a leg, or any other appropriate measurement site. In addition, although the embodiment of the patient monitoring system **12** illustrated in FIG. **7** relates to photoplethysmography or regional oximetry, the system **12** may be configured to obtain a variety of medical measurements with a suitable medical sensor. For example, the system **12** may additionally be configured to determine patient electroencephalography (e.g., a bispectral index), or any other desired physiological parameter such as water fraction, end-title CO_2, or hematocrit.

[0028] As noted, the system **12** includes the sensor **134** that is communicatively coupled to the patient monitor **16**. The sensor **134** may be reusable, entirely disposable, or include disposable portions. If the sensor **134** is reusable, it may include a disposable adhesive pad that may be replaced. Although only one sensor **134** is shown coupled to the monitor **16** in FIG. **7**, in other embodiments, two, three, four, or more sensors **134** may be coupled to the monitor **16**. For example, two sensors **134** may be used for cerebral oximetry and simultaneously two other sensors **134** used for somatic oximetry. As shown in FIG. **7**, the sensor **134** includes an emitter **136** and a pair of detectors **138** (e.g., **138**A, **138**B). The emitter **136** and detectors **138** of the sensor **134** may be coupled to the monitor **16** via a cable. The cable may interface directly with the sensor **134** and may include a plurality of conductors (e.g., wires). In certain embodiments, the sensor

134 may be configured to store patient-related data, such as historical regional oximetry data (e.g., rSO_2 values).

[0029] The monitor 16 may be any suitable monitor, such as an INVOS® System monitor available from Covidien Corporation. The monitor 16 includes the monitor display 18 configured to display information regarding the physiological parameters monitored by the sensor 134, information about the system, and/or alarm indications. In addition, the monitor 134 may display information related to the user, a selected procedure, potential event markers, selected event markers, and other information (see FIG. 6). The monitor 16 may also include a speaker 140 to communicate information related to the physiological parameters (e.g., alarms). The monitor 16 may include various input components 142, such as knobs, switches, keys and keypads, buttons, touchscreen, etc., to provide for operation and configuration of the monitor 16. The input components 142 may enable the inputting of user information and/or selection of procedures and/or event markers. In certain embodiments, the display 18 may be used as the user interface 14 described above. The monitor 16 also includes the processor 24 that may be used to execute code, such as code for implementing various monitoring functionalities enabled by the sensor 134. As discussed below, for example, the monitor 16 may be configured to process signals generated by the detectors 134 to estimate the amount of oxygenated vs. de-oxygenated hemoglobin in a monitored region of the patient (e.g., brain). In some embodiments, the sensor 134 may include a processor that may be used to execute code stored in a memory of the sensor 134 to perform all or some of the functionalities described throughout related to calculating an rSO_2 value.

[0030] The monitor 16 may be any suitable monitor, such as an INVOS® System monitor available from Covidien Corporation. In certain embodiments, the sensor 134 may be a wireless sensor 134. Accordingly, the wireless sensor 134 may establish a wireless communication with the patient monitor 16, the multi-parameter patient monitor 20, and/or network 29 using any suitable wireless standard. In certain embodiments, a pre-amplifier may be utilized between the sensor 134 and monitor 16. In this embodiment, wireless communication may occur between the pre-amplifier, sensor 134, monitor 20, and/or the network 29. By way of example, the wireless module may be capable of communicating using one or more of the ZigBee standard, WirelessHART standard, Bluetooth standard, IEEE 802.11x standards, or MiWi standard.

[0031] As provided herein, the sensor 134 may be configured to perform regional oximetry. Indeed, in one embodiment, the sensor 134 may be an INVOS® cerebral/somatic sensor available from Covidien Corporation. In regional oximetry, by comparing the relative intensities of light received at two or more detectors, it is possible to estimate the blood oxygen saturation of hemoglobin in a region of a body. For example, a regional oximeter may include a sensor to be placed on a patient's forehead and may be used to calculate the oxygen saturation of a patient's blood within the venous, arterial, and capillary systems of a region underlying the patient's forehead (e.g., in the cerebral cortex). As illustrated in FIG. 7, the sensor 134 may include the emitter 136 and the two or more detectors 138: one detector 138A that is relatively "close" to the emitter 136 and another detector 138B that is relatively "far" from the emitter 136. Light intensity of one or more wavelengths may be received at both the "close" and the "far" detectors 138A and 138B. Thus, the detector 138A may receive a first portion of light and the detector 138B may receive a second portion of light. Each of the detectors 138 may generate signals indicative of their respective portions of light. For example, the resulting signals may be contrasted to arrive at a regional saturation value that pertains to additional tissue through which the light received at the "far" detector 138B passed (tissue in addition to the tissue through which the light received by the "close" detector 138A passed, e.g., the brain tissue) when it was transmitted through a region of a patient (e.g., a patient's cranium). Surface data from the skin and skull is subtracted out to produce a regional oxygen saturation (rSO_2) value for deeper tissues.

[0032] The emitter 136 and the detectors 138 may be arranged in a reflectance or transmission-type configuration with respect to one another. However, in embodiments in which the sensor 134 is configured for use on a patient's forehead, the emitter 136 and detectors 138 may be in a reflectance configuration. An emitter 136 may also be a light emitting diode, superluminescent light emitting diode, a laser diode, or a vertical cavity surface emitting laser (VCSEL). An emitter 136 and the detectors 138 may also include optical fiber sensing elements. Also, the emitter 136 may include two light emitting diodes (LEDs) 144 and 146 that are capable of emitting at least two wavelengths of light, e.g., red or near infrared light. In one embodiment, the LEDs 144 and 146 emit light in the range of about 600 nm to about 1000 nm. In a particular embodiment, the one LED 144 is capable of emitting light at 730 nm and the other LED 146 is capable of emitting light at 810 nm. In another particular embodiment, the emitter 136 may include four LEDs configured to emit at least four wavelengths of light of peak wavelengths of approximately 730 nm, 770 nm, 810 nm and 850 nm. It should be understood that, as used herein, the term "light" may refer to one or more of ultrasound, radio, microwave, millimeter wave, infrared, near-infrared, visible, ultraviolet, gamma ray or X-ray electromagnetic radiation, and may also include any wavelength within the radio, microwave, infrared, visible, ultraviolet, or X-ray spectra, and that any suitable wavelength of light may be appropriate for use with the present disclosure.

[0033] In any suitable configuration of the sensor 134, the detectors 138A and 138B may be an array of detector elements that may be capable of detecting light at various intensities and wavelengths. In one embodiment, light enters the detector 138 (e.g., detector 138A or 138B) after passing through the tissue of the patient 148. In another embodiment, light emitted from the emitter 136 may be reflected by elements in the patient's tissue to enter the detector 138. The detector 138 may convert the received light at a given intensity, which may be directly related to the absorbance and/or reflectance of light in the tissue of the patient 148, into an electrical signal. That is, when more light at a certain wavelength is absorbed, less light of that wavelength is typically received from the tissue by the detector 138, and when more light at a certain wavelength is reflected, more light of that wavelength is typically received from the tissue by the detector 138. After converting the received light to an electrical signal, the detector 138 may send the signal to the monitor 16, where physiological characteristics may be calculated based at least in part on the absorption and/or reflection of light by the tissue of the patient 148.

[0034] In certain embodiments, the medical sensor 134 may also include an encoder 150 that may provide signals indicative of the wavelength of one or more light sources of

the emitter **136**, which may allow for selection of appropriate calibration coefficients for calculating a physical parameter such as blood oxygen saturation. The encoder **150** may, for instance, include a coded resistor, an electrically erasable programmable read only memory (EEPROM), or other coding device (such as a capacitor, inductor, programmable read only memory (PROM), RFID, parallel resident currents, or a colorimetric indicator) that may provide a signal to the microprocessor **24** related to the characteristics of the medical sensor **134** to enable the microprocessor **24** to determine the appropriate calibration characteristics of the medical sensor **134**. Further, the encoder **150** may include encryption coding that prevents a disposable part of the medical sensor **134** from being recognized by a microprocessor **24** unable to decode the encryption. For example, a detector/decoder **152** may translate information from the encoder **150** before the processor **24** can properly handle it. In some embodiments, the encoder **150** and/or the detector/decoder **152** may not be present.

[0035] In certain embodiments, the sensor **134** may include circuitry that stores patient-related data (e.g., rSO_2) and provides the data when requested. The circuitry may be included in the encoder **150** or in separate memory circuitry within the sensor **134**. Examples of memory circuitry include, but are not limited to, a random access memory (RAM), a FLASH memory, a PROM, an EEPROM, a similar programmable and/or erasable memory, any kind of erasable memory, a write once memory, or other memory technologies capable of write operations. In one embodiment, patient-related data, such as the rSO_2 values, trending data, or patient monitoring parameters, may be actively stored in the encoder **150** or memory circuitry.

[0036] Returning to FIG. **7**, signals from the detector **138** and/or the encoder **150** may be transmitted to the monitor **16**. The monitor **16** may include one or more processors **24** coupled to an internal bus **154**. Also connected to the bus **154** may be a ROM memory **156**, a RAM memory **158**, and the display **18**. A time processing unit (TPU) **160** may provide timing control signals to light drive circuitry **162**, which controls when the emitter **136** is activated, and if multiple light sources are used, the multiplexed timing for the different light sources. The received signal from the detector **138** may be passed through analog-to-digital conversion and synchronization **164** under the control of timing control signals from the TPU **160**. Specifically, the signal may undergo synchronized demodulation and optionally amplification and/or filtering. For example, the LEDs **144** and **146** may be driven out-of-phase, sequentially and alternatingly with one another (i.e., only one of the LEDs **144** and **146** being driven during the same time interval) such that the detector **138** receives only resultant light spectra emanating from one LED at a time. Demodulation of the signal enables the data associated with the LEDs **144** and **146** to be distinguished from one another. After demodulation, the digital data may be downloaded to the RAM memory **158**.

[0037] In some embodiments, the processor **24** may execute code that utilizes the detected gestures to identify a specific user, to select or identify specific procedures, and/or to select specific event markers (i.e., potential steps of a procedure to be performed on a patient). Further, the processor **24** may retrieve and cause to be displayed (e.g., on display **18**) event markers and/or settings (e.g., patient monitoring or medical device settings such as display settings, alarm thresholds, etc.) for the identified user and/or for an identified or selected procedure. The processor **24** may associate into a single file values for one or more physiological parameters obtained from the patient undergoing the procedure, user identification information (e.g., user code or ID) associated with the specific user, a procedure code identifying the selected procedure performed on the patient, and/or any event markers selected by the specific user during the procedure.

[0038] In an embodiment, based at least in part upon the received signals corresponding to the light received by detector **138**, the processor **24** may calculate the oxygen saturation (e.g., regional oxygen saturation) using various algorithms. These algorithms may use coefficients, which may be empirically determined. For example, algorithms relating to the distance between an emitter **136** and various detector elements in a detector **138** may be stored in the ROM memory **156** and accessed and operated according to processor instructions. Additionally, algorithms may use the value of LED wavelengths encoded in sensor encoder **150**, enabling the algorithm to compensate for LED wavelengths that diverge from nominal wavelengths.

[0039] While the disclosure may be susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and have been described in detail herein. However, it should be understood that the embodiments provided herein are not intended to be limited to the particular forms disclosed. Rather, the various embodiments may cover all modifications, equivalents, and alternatives falling within the spirit and scope of the disclosure as defined by the following appended claims.

What is claimed is:

1. A system comprising:

a user interface configured to detect a first gesture that identifies a specific user; and

a patient monitoring system coupled to the user interface and configured to monitor at least one physiological parameter of a patient;

wherein the patient monitoring system is configured to retrieve and to display one or more event markers for the specific user in response to the detected identifying gesture, the one or more event markers representing steps of a procedure performed on the patient, each event marker of the one or more event markers is associated with a respective reimbursement code;

wherein the patient monitoring system is configured to associate user identification information associated with the specific user with any event marker selected by the specific user during the procedure; and

a billing system configured to receive the user identification information associated with the specific user and any event marker selected by the specific user during the procedure, and the billing system is configured to generate a bill utilizing one or more reimbursement codes associated with one or more respective selected event markers.

2. The system of claim **1**, wherein the user interface is configured to detect a second gesture, and wherein the second gesture identifies a corresponding procedure to be performed on the patient.

3. The system of claim **2**, wherein the patient monitoring system is configured to retrieve and to display specific event markers associated with the corresponding procedure.

4. The system of claim **1**, wherein the patient monitoring system is configured to determine if the first gesture is unique

relative to other gestures and to associate the first gesture with the specific user if the first gesture is unique.

5. The system of claim **1**, wherein the patient monitoring system is configured to retrieve and to display patient monitoring system settings customized for the specific user in response to the first gesture.

6. The system of claim **5**, wherein the patient monitoring systems settings comprises at least one of how different values of the at least one physiological parameter are displayed, one or more alarm thresholds for the at least one physiological parameter, an order of display for a plurality of physiological parameters, which physiological parameters of the plurality of physiological parameters to display, or a combination thereof.

7. The system of claim **1**, wherein the patient monitoring system comprises at least one medical device to monitor the at least one physiological parameter, and the at least one medical device comprises the user interface.

8. The system of claim **7**, wherein the at least one medical device comprises a pulse oximetry monitor or a regional oximetry monitor.

9. The system of claim **1**, wherein the first gesture comprises a touch-based gesture and user interface comprises a touchscreen configured to detect the touch-based gesture.

10. A monitor comprising:

a user interface configured to detect a first gesture that identifies a specific user; and

a processing device coupled to the user interface and configured to retrieve one or more event markers for the specific user in response to the detected first gesture, the one or more event markers representing steps of a procedure performed on a patient, and the processing device is configured to associate user identification information associated with the specific user with any event markers selected by the specific user during the procedure.

11. The monitor of claim **10**, comprising a port configured to couple to a sensor applied to the patient, wherein the processing device is configured to receive a signal from the sensor and to calculate at least one physiological parameter from the received signal, and the processing device is configured to associate values of the at least one physiological parameter obtained from the patient with the user identification information and selected event markers.

12. The monitor of claim **10**, wherein the user interface is configured to detect a second gesture, and wherein the second gesture identifies a corresponding procedure to be performed on the patient and causes the processing device to retrieve a code for the corresponding procedure identified.

13. The monitor of claim **12**, wherein the processing device is configured to retrieve specific event markers associated with the corresponding procedure identified.

14. The monitor of claim **11**, wherein first gesture comprises a touch-based gesture, and the user interface comprises a touchscreen configured to detect the touch-based gesture.

15. The monitor of claim **10**, wherein the processing device is configured to determine if the first gesture is unique relative to other gestures and to associate the first gesture with the specific user if the first gesture is unique.

16. A method comprising:

detecting, via a user interface, identifying first gesture that identifies a specific user;

retrieving and displaying, via a patient monitor, one or event markers for the specific user in response to the detected first gesture, wherein the one or more event markers represent steps of a procedure performed on a patient; and

associating, via the patient monitor, user identification information associated within the specific user with any event makers selected by the specific user during the procedure.

17. The method of claim **16**, comprising detecting, via the user interface, a second gesture that identifies and selects a corresponding procedure to be performed on the patient.

18. The method of claim **16**, comprising determining, via the patient monitor, if the first gesture is unique relative to other gestures and to associate the first gesture with the specific user if the identifying gesture is unique.

19. The method of claim **16**, wherein each event marker of the one or more event markers is associated with a respective reimbursement code.

20. The method of claim **16**, comprising receiving the user identification information associated with the specific user and any event marker selected by the specific user during the procedure, and generating a bill utilizing one or more reimbursement codes associated with one or more respective selected event markers.

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专利名称(译)	用户与医疗设备交互的系统和方法		
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申请(专利权)人(译)	COVIDIEN LP		
当前申请(专利权)人(译)	COVIDIEN LP		
[标]发明人	SILVEIRA PAULO E X		
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摘要(译)

根据各种实施例，系统可以包括用户界面，该用户界面被配置为检测标识特定用户的第一手势。该系统还可以包括耦合到用户界面的患者监测系统，该患者监测系统被配置为监测患者的至少一个生理参数。患者监测系统可以被配置为响应于检测到的第一手势检索并显示特定用户的一个或多个事件标记。一个或多个事件标记表示对患者执行的过程的步骤，并且一个或多个事件标记的每个事件标记与相应的报销代码相关联。系统可以传送与特定用户相关联的用户识别信息和所选择的事件标记，以便自动计费和报销批准的医疗程序。