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(54) Physiologic signal processing method comprising the emission and detection of light and a remote preprocessing step

Verfahren zur Verarbeitung physiologischer Signale umfassend die Ausstrahlung und die Ermittlung von Licht und eine entfernte Vorverarbeitung

Procédé pour le traitement de signaux physiologiques comprenant l'émission et la détection de lumière ainsi qu'un prétraitement à distance

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(73) Proprietor: **Nonin Medical, Inc**
Plymouth, MN 55441-5443 (US)

(72) Inventor: **ISAACSON, Philip, O.**
Chanhassen, Minnesota 55317 (US)

(74) Representative: **Catherine, Alain et al**
Cabinet HARLE et PHELIP
14-16, rue Ballu
75009 Paris (FR)

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Description

Field of the Invention

[0001] The present invention relates to a physiologic signal processing method. The present disclosure further relates to a sensor assembly and system adapted to improve sensor utility by storing information representative of multiple characteristics of the sensor, patient and application within a memory of the sensor assembly.

Background of the Invention

[0002] Non-invasive physiological monitoring is a common means for testing, detecting and treating a physiological condition. Typically, non-invasive monitoring techniques such as pulse oximetry, electrocardiography (ECG), electroencephalography (EEG) and ultrasonic imaging require that a sensor be placed in direct contact with a patient undergoing the procedure.

[0003] Pulse oximetry involves the non-invasive monitoring of oxygen saturation level in blood-perfused tissue indicative of certain vascular conditions. Pulse oximetry is typically used to measure various blood flow characteristics including, but not limited to, the blood-oxygen saturation of hemoglobin in arterial blood, the volume of individual blood pulsations supplying the tissue and the rate of blood pulsations corresponding to each heartbeat of a patient. Measurement of these characteristics has been accomplished by use of a non-invasive sensor which passes light through a portion of the patient's tissue where blood perfuses the tissue, and photoelectrically senses the absorption of light in such tissue. The amount of light absorbed is then used to calculate the amount of blood constituent being measured. Oxygen saturation may be calculated using some form of the classical absorption equation know as Beer's law.

[0004] The light passed through the tissue is typically selected to be of one or more wavelengths that are absorbed by the blood in an amount representative of the amount of the blood constituent present in the blood. The amount of transmitted light passed through the tissue will vary in accordance with the changing amount of blood constituent in the tissue and the related light absorption. For measuring blood oxygen level, such sensors have been provided with light sources and photodetectors that are adapted to operate at two different wavelengths, in accordance with known techniques for measuring blood oxygen saturation.

[0005] Known sensors include an optical oximeter probe which uses a pair of light emitting diodes (LEDs) to direct light through blood-perfused tissue, with a detector picking up light which has not been absorbed by the tissue. The operation depends upon knowing the wavelength of the LEDs. Since the wavelength of LEDs can vary, a coding resistor can be placed in the probe with the value of the resistor corresponding to the actual wavelength of at least one of the LEDs. When the oximeter instrument is turned on, it first applies a current to the coding resistor and measures the voltage to determine the value of the resistor and thus the value of the wavelength of the LED in the probe. U.S. Patent No. 4,700,708 discloses such an encoding mechanism.

[0006] U.S. Pat. No. 5,259,381 recognizes that the coded value of the wavelength of the red LED provided by a coding resistor may be inaccurate, since the actual wavelength can vary with temperature. Accordingly, this patent teaches including a temperature sensor in the oximeter probe to measure the actual temperature. With the actual temperature and the coded wavelength value, a look-up table can be consulted to determine the actual LED wavelength for that temperature.

[0007] Another method of storing coded information regarding the characteristics of the LEDs is shown in U.S. Pat. No. 4,942,877. This patent discloses using an EPROM memory to store digital information which can be provided in parallel or serially from the sensor probe to the remote oximeter. The memory is described as storing coefficients for the saturation equation, wavelength, subwavelength (secondary emission), half-width of wavelength spectrum emitted by LED, intensity of LEDS or ratio and on time of LEDS (written by the processor).

[0008] Other examples of coding probe characteristics exist in other areas. Multiple calibration values are sometimes required, with this making the circuitry more complex or requiring many leads. In U.S. Pat. No. 4,446,715, assigned to Camino Laboratories, Inc., a number of resistors are used to provide coded information regarding the characteristics of a pressure transducer. U.S. Pat. No. 3,790,910 discloses another pressure transducer with a ROM storing characteristics of the individual transducer. U.S. Pat. No. 4,303,984 shows another probe with digital characterization information stored in a PROM, which is read serially using a shift register. Typically, the coding element is mounted in the probe itself. For instance, U.S. Pat. No. 4,621,643 shows the coding resistor mounted in the probe element itself. In addition, U.S. Pat. No. 5,246,003 shows the coding resistor being formed with a printed conductive material on the probe itself.

[0009] In some devices, an electrical connector coupled by a cable to a device attached to a patient may include a coding element. For example, U.S. Pat. No. 3,720,199 shows an intra-aortic balloon catheter with a connector between the catheter and a console. The connector includes a resistor with a value chosen to reflect the volumetric displacement of the particular balloon. U.S. Pat. No. 4,684,245 discloses a fiber optic catheter with a module between the fiber optic and electrical wires connected to a processor. The module converts the light signals into electrical signals and includes a memory storing calibration signals so the module and catheter can be disconnected from the processor and used with a different processor without requiring a recalibration.

[0010] U.S. Pat. No. 5,645,059 teaches using a modulated signal to provide the coded data to a remote analyzer. U.S. Pat. No. 5,429,129 shows using a voltage regulator to produce a specific voltage value in response to an attempt to read by the analyzer.

[0011] U.S. Pat. No. 5,058,588 teaches an oximeter sensor with an encoding element that could be a resistor, ROM, or customized integrated circuit. The encoding element encodes the type of sensor (in particular, type indicating area of placement on body--finger, ear, foot, arm; also, the type of sensor can indicate transmission/reflection type, or adult/neonate (indicating correction to be performed on theoretical oxygen saturation, allow switching between physiological limits such as minimum/maximum pulse rates for adults/neonates); the maximum driving current may be adapted according to type of sensor, and contact of sensor with tissue can be tested by means of an attenuation measurement if sensor type is known).

[0012] U.S. Pat. No. 5,645,059. teaches coding information in sensor memory used to provide a pulse modulated signal, to indicate the type of sensor (finger, nose), the wavelength of a second LED, the number of LEDs, the numerical correction terms to the standard curves, and an identifier of the manufacturer.

[0013] A number of catheter patents also discuss encoding information in the catheter. Sentron U.S. Pat. No. 4,858,615 teaches encoding the type of sensor, type number, serial number, date of production, safe use life of the sensor, correction data for non-linearity, pressure sensitivity, offset and temperature sensitivity.

[0014] Interflo Medical Published PCT Application No. PCT/US92/08263, Publication No. WO 93/06776 teaches encoding patient specific data, size, manufacture date, batch number, sterilization date, expiration date, transducer number and type, manufacturer's name and address, thermistor heating element resistance, filament efficiency, program segments or patient historical data, format version for the calibration data, trademark information, catheter unique serial number, ship date, other date and time information, security code to identify manufacturer, thermal mass, filament composition, coefficient of resistance, layout byte, checksum, copyright, number of seconds since a certain date, patient weight, patient height, timestamp of data point and a count of all CO data points in EEPROM.

[0015] U.S. Pat. No. 5,162,725 describes storing both calibration and ID information in a sensor memory. U.S. Pat. No. 5,016,198 describes a coding memory in a sensor with data for defining a sensor's characteristic curve. U.S. Pat. No. 4,303,984 describes a memory which stores characterization information, such as linearization information for a pressure sensor. U.S. Pat. No. 5,365,462 describes a date code in a sensor memory. U.S. Pat. No. 4,734,873 describes a pressure sensor with a PROM storing coefficients for a polynomial. U.S. Pat. No. 4,845,649 describes a PROM in a sensor storing correcting data. U.S. Pat. No. 5,070,732 shows calibration data in a sensor memory. U.S. Pat. No. 5,720,293 talks about different calibration information for a catheter, including a security code (encryption is discussed), serial number, model number, ID data such as calibration, manufacture, sterilization and ship date or other date and time information, a software program segment, security code for identifying whether sensor made by same manufacturer as monitor manufacturer, filament or transducer resistance, heat transfer coefficient, thermal mass, filament composition and coefficient of resistance, layout byte, copyright notice, checksum, random data bytes. U.S. Pat. No. 5,008,843 describes a sensor with EEPROM ID and characteristics data.

[0016] US-2005/0234317 concerns a low power and personal pulse oximetry system. Personal pulse oximetry systems and methods are disclosed which provide monitoring, powering, and wireless communications for measurement of an individual's blood level in medical, military, or athletic applications.

[0017] WO-2000/053082 concerns a method and circuit for storing and providing historical physiological data. A mechanism is disclosed for storing and providing historical physiological data, such as blood oxygen saturation data, for a patient.

[0018] As detailed herein, the benefits of storing coefficients which comprehensively include a variety of different characteristics include improved sensor accuracy, system flexibility and the ability to utilize updated sensors with existing monitoring equipment.

Brief Summary

[0019] A sensor system is disclosed which provides measurement accuracy and system flexibility. In one case the sensor assembly includes a portable sensor and a memory element. The portable sensor can include many known sensors used for the monitoring of physiological parameters.

[0020] The memory element can store equation coefficients used in a process to determine a physiologic measurement. For example, the equation coefficients may be utilized to determine blood oxygen levels using well known blood oxygen saturation equations. The coefficients represent a combination of many different characteristics, including but not limited to: sensor-specific characteristics, application-specific characteristics and patient-specific characteristics, referred herein in combined form as SAP-specific characteristics.

[0021] In one case the coefficients defined by the SAP-specific characteristics are stored in a memory on the portable sensor and are communicated to a monitor for subsequent processing with a predetermined equation accessed by the monitor. The predetermined equation may be stored within a memory element of the monitor or otherwise communicated to the monitor.

[0022] In another case, the coefficients defined by the SAP-specific characteristics along with an associated equation are stored in a memory of the portable sensor. Both the coefficients and equation are communicated to a monitor for subsequent processing.

[0023] In yet another case, the coefficients defined by the SAP-specific characteristics along with an associated equation are stored in a memory of the portable sensor and are communicated to a processor within the sensor assembly. The internal processor is provided in communication with the monitor and may receive commands to initiate computations and transmit processed physiologic measurement to a monitor for subsequent display and/or storage.

[0024] The foregoing has outlined rather broadly the features and technical advantages of the sensor system in order that the detailed description that follows may be better understood. It should be appreciated by those skilled in the art that the conception and specific sensor system disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes. It is to be expressly understood, however, that each of the figures is provided for the purpose of illustration and description only and is not intended as a definition of the limits of the present invention.

Brief Description of the Drawings and Figures

[0025] From an inspection of the drawings, when considered in connection with the following description, the subject matter sought to be protected, its construction and operation, and many of its advantages should be readily understood and appreciated.

FIG. 1 is a block diagram of a first version of a sensor system.

FIG. 2 is a block diagram of a second version of a sensor system.

FIG. 3 is a block diagram of a third version of a sensor system. .

Detailed Description

[0026] For the purposes of explanation only, the present sensor system is disclosed utilizing a system that is configured for the measurement of oxygen saturation through known oximetric transmittance techniques. As one skilled in the art can readily appreciate, the present system is easily adaptable to accommodate a number of different physiological monitoring applications and configurations, including but not limited to, other optical sensors, reflective sensor.

[0027] Fig. 1 illustrates a sensor system 10, including a sensor assembly 20 and sensor monitor 30 adapted as an electro-optical blood oxygen saturation sensor for a fingertip. In the illustrated cases, sensor assembly 20 is utilized within a system including a monitoring unit for oxygen saturation measurement. A variety of different sensor assemblies can be utilized. For example, the sensor assembly 20 may includes a molded polymeric body and sensor holder, such as disclosed in U.S. Serial No. 10/988,040, entitled Sensor Assembly, assigned to the present assignee. Sensor assembly 20 may include an oximetric sensor having one or more LED's and one or more photodetectors and being connected to the monitoring unit via a lead wire. The sensor assembly 20 can also or alternatively contain other known components utilized in the measurement of oxygen saturation. Pulse oximeter systems are disclosed in U.S. Patents 5,490,523, 5,800,349, and Re. 33643, all to Isaacson et al, and all assigned to the present assignee, Nonin Medical, Inc.

[0028] Sensor assembly 20 of FIG. 1 includes a memory element 24 and a sensor 26 which provides a signal to the sensor monitor 30 via line 28. Sensor 26 may include an oximetric sensor having one or more LED's and one or more photodetectors. Alternatively, sensor 26 may include other sensors for the measurement of physiological parameters such as oxygen or carbon dioxide in the blood, a measuring apparatus for the measurement of the carbon dioxide content, an optical measuring apparatus with means for the pulse oximetric measurement of the arterial oxygen saturation comprising an LED and a photodetector, a measuring apparatus for the measurement of the pulse frequency, a measuring apparatus for the measurement of the hematocrit (HCT), a measuring apparatus for the measurement of the blood pressure (CNIBP), a measuring apparatus for the measurement of components of the respiratory gas, a measuring apparatus for the measurement of the body temperature and a measuring apparatus for the measurement of the moisture content. In addition, sensor 26 be used to measure certain other physiologic parameters as would be appreciated by those of ordinary skill in the relevant art. Sensor 26 may include digital or analog signal components or both.

[0029] Memory 24 may include digital and/or analog memory structures, including but not limited to random access memory (RAM), a FLASH memory, a programmable read only memory (PROM), an electrically erasable PROM, any kind of erasable memory, a write once memory, or other memory technologies capable of write operations. Analog memory structures may include, for example, a simple resistor network such as disclosed in the prior art referenced in the Brief Summary.

[0030] Referring still to FIG. 1, sensor monitor 30 includes an analog signal processing element 32, an analog to digital conversion element 34, a digital signal processing element 36, a processor 38, a memory element 40 and a storage or display element 42 to provide information relating to the measured physiological parameter. One or more of these various elements of sensor monitor 30 maybe implemented in hardware, software or a combination of hardware and software. Those of ordinary skill in the art will appreciate that various additional elements and/or components may be included in a functional system or that elements of sensor monitor 30 may be unnecessary or optional.

[0031] Sensor monitor 30 is in communication with sensor assembly 20 via line 28. The connection between sensor monitor 30 and sensor assembly can be by wireless telemetry, a cell phone data transmittal protocol or via known electronic communication systems. Line 28 may communicate digital or analog signals or both. Line 28 may comprise a combination of hard lines and wireless channels. Line 28 may represent telemetry line(s) operating via FM or PCM/FM modulation. Alternative wireless technologies may also be applicable to communicate information between sensor assembly 20 and sensor monitor 30.

[0032] Memory 24 of sensor 20 stores equation coefficients used in the process to determine a physiologic measurement. In the example of FIG. 1, the equation coefficients are utilized to determine blood oxygen levels. The coefficients represent a combination of multiple different characteristics, including but not limited to sensor-specific characteristics, application-specific characteristics and patient-specific characteristics.

Sensor-specific characteristics include:

[0033]

- spectral characteristics of the light emitting element(s), such as wavelength, intensity, spectral bandwidth and secondary emissions.
- light emitting element parameters such as drive level, LED spacing, LED orientation relative to other components of the sensor assembly, collimation of light to tissue site, area of illumination at tissue site.
- light detecting element characteristics, such as response nonlinearities, spectral response, area of detection at tissue site, collimation of light from tissue site.
- sensor type, such as whether the sensor functions as a transmissive or reflective sensor or both.
- sensor pressure relating to the compressive force applied to the tissue site by the mechanical structure of the sensor,
- sensor light transmissive or reflective characteristics relating to materials of construction, such as whether the sensor is colored, opaque, translucent.
- alignment between light emitting element and light detecting element, e.g., offset or aligned.

Application-specific characteristics include:

[0034]

- location of the sensor upon the patient, for example, whether the sensor is secured at an extremity or some other location of the patient, degree of perfusion at sampled tissue site relative to other tissue sites.
- alignment of the sensor element(s) relative to the patient, for example, whether the sensor elements are parallely or transversly aligned relative to the longitudinal direction of a finger.
- sensor displacement during use, for example, some sensors are more likely to be subject to displacement forces during use which may corrupt the measured physiologic signal.
- sensor temperature during use.
- the effects of external light sources, such as interference from sunlight or other external light sources.

Patient-specific characteristics include:

[0035]

- patient age
- gender of patient
- patient size (neonate, pediatric, juvenile, adult applications)
- medical conditions of patient
- skin color
- patient species information (human, veterinary application, etc.)

[0036] The above referenced sensor-specific, application-specific, and patient-specific characteristics include many known factors which may each influence the coefficients stored in sensor assembly memory 24. The above identified examples of characteristics are not meant to be a comprehensive collection. Other known characteristics may be utilized to determine the coefficients of the sensor system. In this regard, the stored coefficients represent a combination of the plurality of different characteristics.

[0037] FIG. 2 illustrates another case wherein a calibration equation including calibration coefficients is stored in memory element 24. In use, the equation is communicated to the sensor monitor 30 and is used to calculate the physiologic parameter based on the received signal from sensor 26. The equations stored in memory element 24 may include polynomials, logarithmics, exponentials or power-type equations. In this regard an optimally appropriate equation and calibration coefficients can be communicated to the sensor monitor 30, resulting in improved accuracy and flexibility.

[0038] FIG. 3 illustrates yet another case wherein a calibration equation including calibration coefficients is stored in memory element 24. In addition, sensor 20 includes a sensor processor 46 for processing data from sensor 26 with reference to the stored calibration equation and coefficients. Sensor processor 46 and memory element 24 may be discrete elements or may be combined within a single device, such as a programmable logic controller or another electronic device as appreciated by those of ordinary skill in the relevant arts. As illustrated in FIG. 3, a preprocessed physiological measurement signal (x) is sent to sensor processor 46 via line 28b. The preprocessed signal (x) is a function of the electrical signal from the physiologic measurement of sensor 26 which is communicated to monitor 30 via line 28c. The preprocessed signal (x) may include amplitude information for a red light signal and for an infrared light signal. In another case, the preprocessed signal (x) may include time derivative information of the red and infrared light signals from sensor 26. Sensor processor 46 calculates a blood oxygen saturation or other measurement based on the preprocessed signal (x) and the stored calibration equation and coefficients and communicates the information via line 28a to the oximeter monitor 30 for subsequent storage and/or display. This may yield an improvement in sensor flexibility and accuracy of the reading. Processor 46 may include a microcontroller with memory or a microprocessor and interfaces on a single chip. Other processor 46 technologies may also be applicable .

[0039] Signals lines 28 represent communication paths between sensor 20 and monitor 30. Communication may be via analog communication and/or digital communication. Signal lines 28 may be represented by one or more discrete conductors. Signal lines 28 may represent wireless communication between sensor 20 and monitor 30. Bidirectional communication over a single line may require additional electronic components, such as multiplexors. Those of ordinary skill in the relevant arts would appreciate that a variety of different communication approaches may be utilized . For example, the signal line 28 associated with sensor 26 may be an analog channel. In another case, the signal line 28 associated with sensor 26 may be a digital channel with appropriate analog-to-digital conversion being handled within sensor 20.

[0040] It may be necessary to update the calibration coefficients stored within memory element 24 as technology progresses and the operating parameters are refined or changed. Because sensor 20 would typically be much less expensive to replace than the system monitor 30, it is desirable to provide data corresponding to the updated coefficients in the sensors rather than in the sensor monitors.

Claims

1. A physiologic signal processing method comprising:

   emitting light from a light emitting element on a sensor assembly (20);
   detecting light with a light detecting element on the sensor assembly (20); storing information on a memory (24) on the sensor assembly (20), whereby said information includes coefficients for use to determine physiologic quantities based upon light signals received from the light detecting element, said coefficients being derivable as a combination of different sensor-specific characteristics, application-specific characteristics and patient-specific characteristics, said information also including an equation for use to compute a physiologic parameter; and
   the method further comprising:
   determining a preprocessed signal at a remote monitor (30) said preprocessed signal being derived from an electrical signal from the light detecting element; and
   with a processor (46) on said sensor assembly (20) determining said physiologic quantities based upon the coefficients and the equation information, **characterized in** the method further comprises
   communicating said preprocessed signal from said monitor (30) to said sensor assembly (20) and **in that** the step of determining the physiologic quantities is further based upon the preprocessed signal.

2. The physiologic signal processing method of claim 1, wherein the preprocessed signal includes information relating to an amplitude of a detected light signal.

3. The physiologic signal processing method of claim 2, wherein the preprocessed signal includes a red light amplitude and an infrared light amplitude.

4. The physiologic signal processing method of claim 2, wherein the preprocessed signal includes time derivatives of a received red light signal, an infrared light signal, or both.

5. The physiologic signal processing methof of any of claims 1 to 4, wherein the physiologic quantities are blood oxygen levels.

6. The physiologic signal processing method of any of claims 1 to 5, wherein the different sensor-specific characteristics include one or more of: light emitting element characteristics, light detecting element characteristics, sensor pressure, sensor type, sensor color, and sensor materials of construction.

7. The physiologic signal processing method of any of claims 1 to 6, wherein the different application-specific characteristics include one or more of: location of sensor assembly (20) upon the patient during use, alignment of the sensor assembly (20) relative to the patient during use, sensor assembly (20) displacement during use, sensor assembly (20) temperature during use, and the effects from external light sources.

8. The physiologic signal processing method of any of claims 1 to 7, wherein the different patient-specific characteristics include one or more of: age, gender, medical conditions of patient, skin color, and patient species information.

Patentansprüche

1. Verfahren zur Verarbeitung physiologischer Signale, das

   Ausstrahlung von Licht durch ein Licht ausstrahlendes Element auf einer Sensoreinheit (20),
   Erfassen von Licht mit einem Lichtdetektorelement auf der Sensoreinheit (20),
   Speichern von Informationen auf einem Speicher (24) auf der Sensoreinheit (20) aufweist, wobei die Informationen Koeffizienten beinhalten, die dazu dienen, physiologische Mengen auf der Grundlage von vom Lichtdetektorelement empfangenen Lichtsignalen zu bestimmen, wobei die Koeffizienten als Kombination von verschiedenen sensorspezifischen Merkmalen, anwendungsspezifischen Merkmalen und patientenspezifischen Merkmalen ableitbar sind, wobei die Informationen auch eine Gleichung beinhalten, die dazu dient, einen physiologischen Parameter zu berechnen, und wobei das Verfahren des Weiteren
   Bestimmen eines vorverarbeiteten Signals auf einem entfernten Monitor (30), wobei das vorverarbeitete Signal von einem elektrischen Signal des Lichtdetektorelements abgeleitet wird, und
   Bestimmen der physiologischen Mengen auf der Grundlage der Koeffizienten und der Gleichungsinformation mittels eines Prozessors (46) auf der Sensoreinheit (20)

   aufweiset,
   dadurch gekennzeichnet, daß das Verfahren des Weiteren Übermitteln des vorverarbeiteten Signals vom Monitor (30) an die Sensoreinheit (20) aufweist und daß der Schritt des Bestimmens der physiologischen Mengen außerdem auf dem vorverarbeiteten Signal beruht.

2. Verfahren zur Verarbeitung physiologischer Signale gemäß Anspruch 1, **dadurch gekennzeichnet, daß** das vorverarbeitete Signal Informationen bezüglich einer Amplitude eines erfaßten Lichtsignals beinhaltet.

3. Verfahren zur Verarbeitung physiologischer Signale gemäß Anspruch 2, dadurch gekenntzeichnet, daß das vorverarbeitete Signal eine Amplitude roten Lichts und eine Amplitude infraroten Lichts beinhaltet.

4. Verfahren zur Verarbeitung physiologischer Signale gemäß Anspruch 2, **dadurch gekennzeichnet, daß** das vorverarbeitete Signal Ableitungen nach der Zeit eines empfangenen Rotlichtsignals, eines Infrarotsignals oder von beiden beinhaltet.

5. Verfahren zur Verarbeitung physiologischer Signale gemäß einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, daß** die physiologischen Mengen Blutsauerstoffwerte sind.

6. Verfahren zur Verarbeitung physiologischer Signale gemäß einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, daß** die verschiedenen sensorspezifischen Merkmale eins oder mehrere der folgenden beinhalten : Merkmale des Licht ausstrahlenden Elements, Merkmale des Lichtdetektorelements, Sensordruck, Sensortyp, Sensorfarbe, Materialarten, aus denen der Sensor aufgebaut ist.

7. Verfahren zur Verarbeitung physiologischer Signale gemäß einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, daß** die verschiedenen anwendungsspezifischen Merkmale eins oder mehrere der folgenden beinhalten : Lage der Sensoreinheit (20) auf dem Patienten während der Benutzung, Ausrichtung der Sensoreinheit (20) in Bezug auf den Patienten während der Benutzung, Verlagerung der Sensoreinheit (20) während der Benutzung, Temperatur der Sensoreinheit (20) während der Benutzung und Einflüsse von äußeren Lichtquellen.

8. Verfahren zur Verarbeitung physiologischer Signale gemäß einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, daß** die verschiedenen patientenspezifischen Merkmale eins oder mehrere der folgenden beinhalten : Alter, Geschlecht, medizinischer Zustand des Patienten, Hautfarbe und Speziesinformationen über den Patienten.

Revendications

1. Procédé pour le traitement de signaux physiologiques, comprenant :

   l'émission de lumière par un élément émetteur de lumière disposé sur un ensemble capteur (20);
   la détection de lumière par un élément détecteur de lumière disposé sur l'ensemble capteur (20);
   le stockage d'informations sur une mémoire (24) prévue sur l'ensemble capteur (20), lesdites informations incluant des coefficients destinés à déterminer des quantités physiologiques sur la base de signaux lumineux reçus de l'élément détecteur de lumière, lesdits coefficients pouvant être dérivés en tant que combinaison de différentes caractéristiques spécifiques au capteur, caractéristiques spécifiques à l'application et caractéristiques spécifiques au patient, lesdites informations comprenant également une équation destinée à calculer un paramètre physiologiques; et le procédé comprenant, en outre,

les étapes suivantes :

la détermination d'un signal pré-traité sur un moniteur à distance (30), ledit signal pré-traité étant dérivé d'un signal électrique émis par l'élément détecteur de lumière; et à l'aide d'un processeur (46) prévu sur ledit ensemble capteur (20), la détermination desdites quantités physiologiques sur la base des informations incluant les coefficients et l'information de l'équation,
caractérisé en ce que le procédé comprend, en outre, la communication dudit signal pré-traité dudit moniteur (30) audit ensemble capteur (20),
et **en ce que** l'étape de détermination des quantités physiologiques est basée, en outre, sur le signal pré-traité.

2. Procédé de traitement de signaux physiologiques selon la revendication 1, dans lequel le signal pré-traité comprend des informations relatives à une amplitude d'un signal lumineux détecté.

3. Procédé de traitement de signaux physiologiques selon la revendication 2, dans lequel le signal pré-traité comprend une amplitude lumineuse rouge et une amplitude lumineuse infrarouge.

4. Procédé de traitement de signaux physiologiques selon la revendication 2, dans lequel le signal pré-traité comprend des dérivées temporelles d'un signal lumineux rouge reçu, d'un signal lumineux infrarouge ou des deux.

5. Procédé de traitement de signaux physiologiques selon l'une quelconque des revendications 1 à 4, dans lequel les quantités physiologiques sont des niveaux d'oxygène dans le sang.

6. Procédé de traitement de signaux physiologiques selon l'une quelconque des revendications 1 à 5. dans lequel les différentes caractéristiques spécifiques aux capteurs comprennent au moins l'une des caractéristiques suivantes : caractéristiques de l'élément émetteur de lumière, caractéristiques de l'élément détecteur de lumière, pression du capteur, type de capteur, couleur du capteur et matériaux de construction du capteur.

7. Procédé de traitement de signaux physiologiques selon l'une quelconque des revendications 1 à 6, dans lequel les différentes caractéristiques spécifiques à l'application comprennent au moins l'une des caractéristiques suivantes : emplacement de l'ensemble capteur (20) sur le patient pendant l'utilisation, alignement de l'ensemble capteur (20) par rapport au patient pendant l'utilisation, déplacement de l'ensemble capteur (20) pendant l'utilisation, température de l'ensemble capteur (20) pendant l'utilisation, et les effets de sources lumineuses externes.

8. Procédé de traitement de signaux physiologiques selon l'une quelconque des revendications 1 à 7, dans lequel les différentes caractéristiques spécifiques aux patients comprennent au moins l'une des caractéristiques suivantes : âge, sexe, conditions médicales du patient, couleur de peau et informations sur l'espèce du patient.

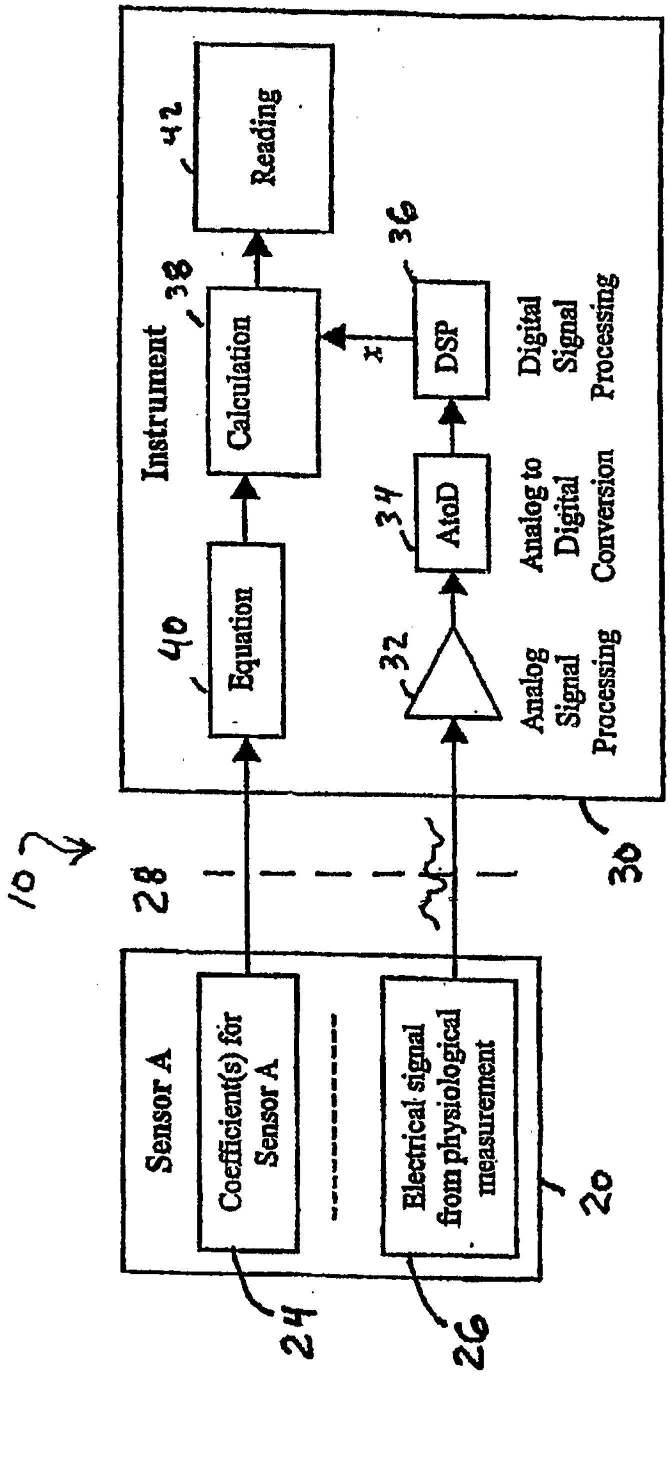
Instrument
Reading
Calculation
Equation
x
DSP
AtoD
Analog Signal Processing
Analog to Digital Conversion
Digital Signal Processing
Sensor A
Coefficient(s) for Sensor A
Electrical signal from physiological measurement
10
20
24
26
28
30
32
34
36
38
40
42

Figure 1

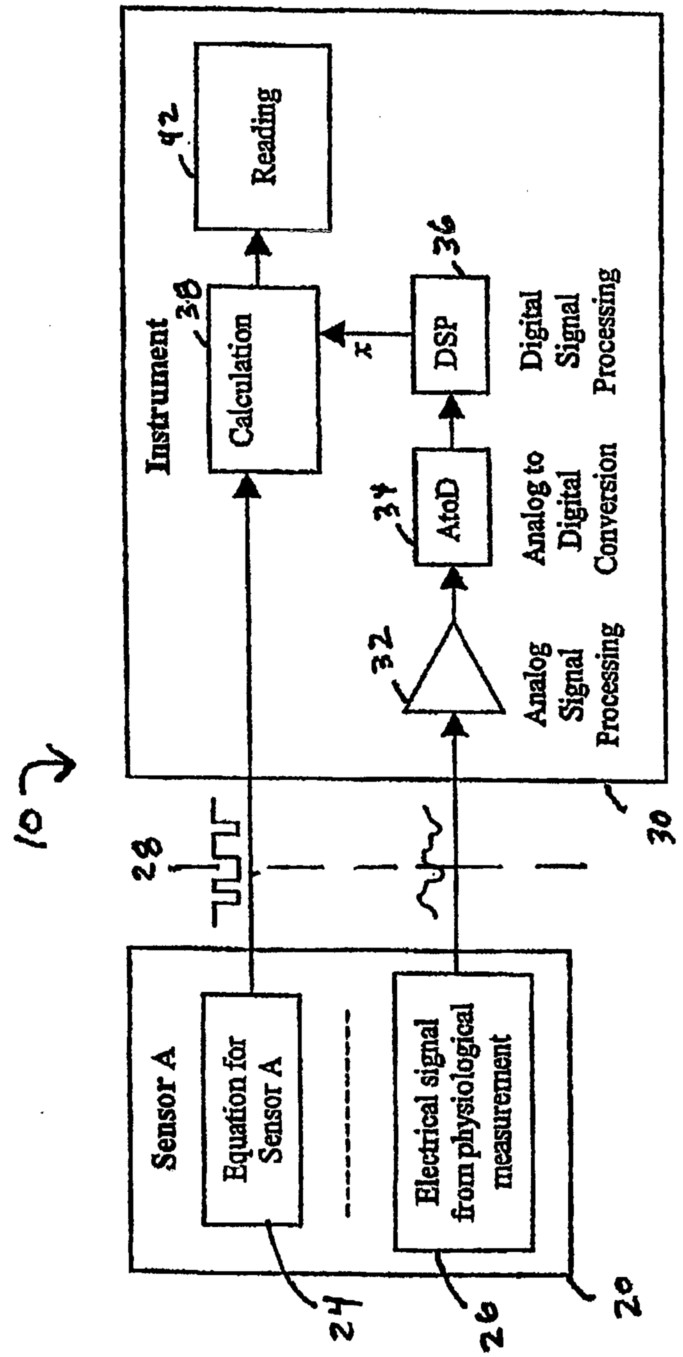
10
Sensor A
Equation for Sensor A
Electrical signal from physiological measurement
24
26
20
28
Instrument
Calculation
38
Reading
42
x
DSP
36
AtoD
34
32
Analog Signal Processing
Analog to Digital Conversion
Digital Signal Processing
30

Figure 2

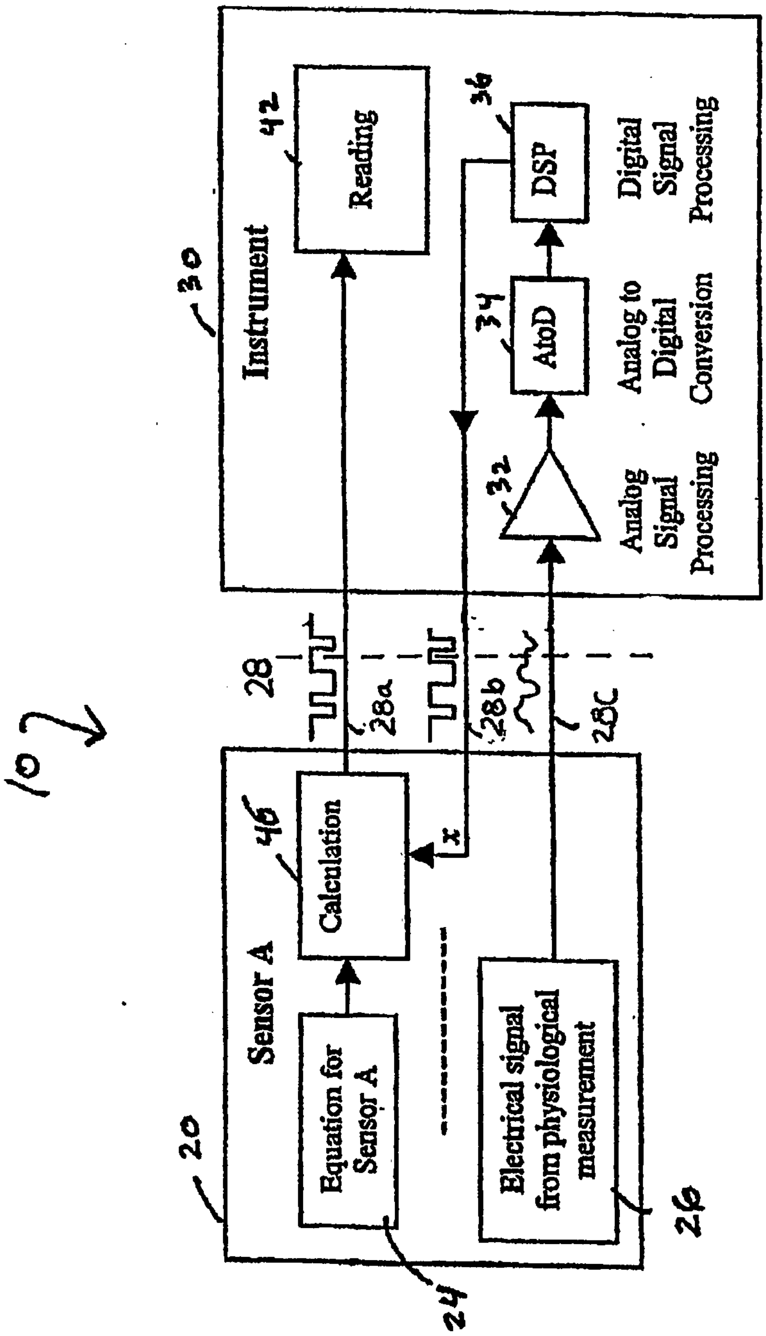
10
20
Sensor A
Equation for Sensor A
24
Calculation
46
x
Electrical signal from physiological measurement
26
28
28a
28b
28c
30
Instrument
Reading
42
DSP
36
AtoD
34
32
Analog Signal Processing
Analog to Digital Conversion
Digital Signal Processing

Figure 3

REFERENCES CITED IN THE DESCRIPTION

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patsnap

专利名称(译)	生理信号处理方法包括光的发射和检测以及远程预处理步骤		
公开(公告)号	EP1983885B1	公开(公告)日	2016-11-02
申请号	EP2006733970	申请日	2006-01-26
[标]申请(专利权)人(译)	NONIN医疗 JOHNSON TIMOTHY大号 CRACKEL JOE R		
申请(专利权)人(译)	NONIN MEDICAL，INC. JOHNSON，TIMOTHY L.		
当前申请(专利权)人(译)	NONIN MEDICAL，INC.		
[标]发明人	ISAACSON PHILIP O		
发明人	ISAACSON, PHILIP, O.		
IPC分类号	A61B5/00 A61B5/024 A61B5/1455 A61B5/1495		
CPC分类号	A61B5/14551 A61B5/02416 A61B5/1495 A61B2562/085		
优先权	11/039760 2005-01-21 US		
其他公开文献	EP1983885A1 EP1983885A4		
外部链接	Espacenet		

摘要(译)

一种使用血氧仪传感器组件的方法，该方法包括以下步骤：检测来自发光元件的光，并将数字数据存储在与传感器组件相关的存储器中。所存储的数字数据包括由与传感器组件耦合的血氧饱和度监测器使用的系数，以根据检测到的光来计算数据，其中，这些系数表示不同的传感器特定特征，应用特定特征和患者特定特征的组合。提供了控制装置，其包括用于响应于所接收的系数以确定血氧水平而根据方程式处理所接收的信息信号的装置。

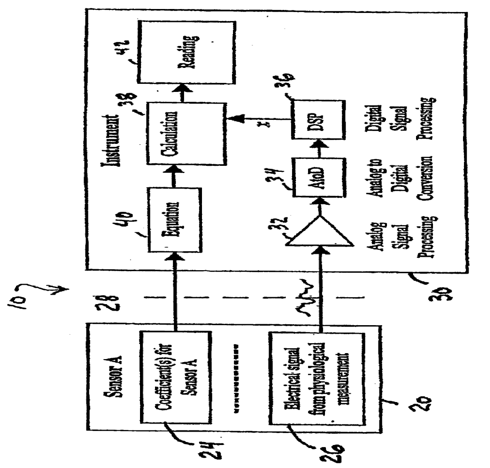

Figure 1