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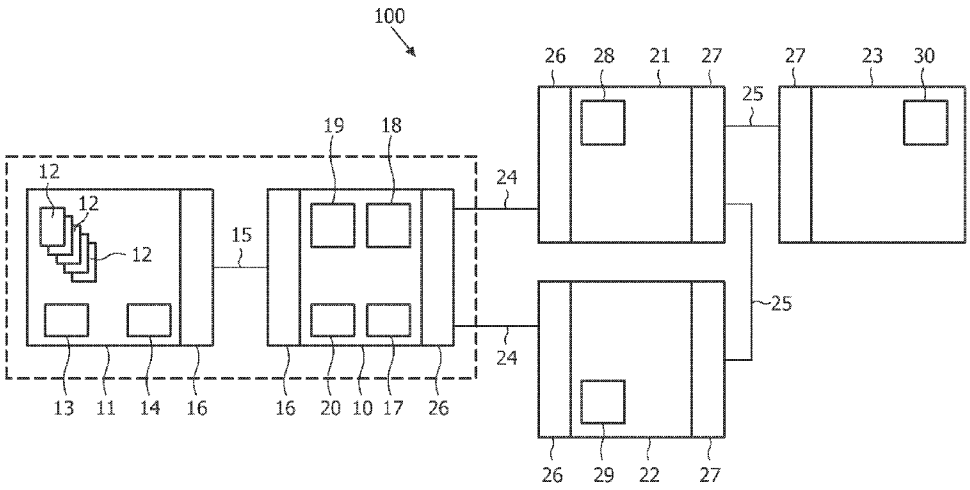
(54) Title: PATIENT MONITORING SYSTEM



(57) Abstract: The present invention relates to a patient monitoring system, a method of monitoring a patient, and a computer program. In order to improve the monitoring of patients, particularly for monitoring cardio pulmonary performance, a patient monitoring system (100) is suggested comprising a patient station (10) linked to a number of sensors (12) for measuring patient data, the number of sensors (12) being integrated into a patient carrier and/or a patient's dress, the patient station (10) being adapted for analyzing the measured patient data, and the patient station (10) being adapted for providing feedback information to the patient by means of a knowledge based system (19), the feedback information being based on the measured patient data. The invention suggest a patient monitoring system (100) which is adapted for working as a CHF management system, in particular for home use.

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Patient monitoring system

The present invention relates to a patient monitoring system, a method of monitoring a patient, and a computer program.

Cardiac diseases (e.g. chronic heart failure) usually have a severe impact on the daily life of the patients, even after they have been discharged from hospital. Besides a strongly reduced physical ability, the patients receive a medication that significantly influences their wellbeing, both in protecting them from the next severe event and in maintaining the physical fitness to a maximum possible level. A key factor in this respect is the control of fluid retention in the patient's body, which is done by applying diuretics. Other medication (e.g. ACE inhibitors, beta blockers, digoxin, anticoagulants, ...) may be applied for the treatment of underlying or accompanying cardiovascular diseases like atrial fibrillation or high blood pressure.

Bedside monitoring of the relevant parameters of patients with cardiac diseases is standard in hospital settings. For example, US 2004/0111045 A1 shows a device and method for patient monitoring of parameters such as body motion, body position, respiratory rate, and/or heart rate, using a sensor device having at least two piezoelectric sensors provided on a surface, such as a bed, so that a patient may be coupled to the device by simply allowing the patient to lie on the surface. It is also known to measure cardiac data or pulmonary data at home.

It is an object of the present invention to improve the monitoring of patients, particularly for monitoring cardiopulmonary performance.

This object is achieved according to the invention by a patient monitoring system comprising a patient station, the patient station being linked to a number of sensors for measuring patient data, the number of sensors being integrated into a patient carrier and/or a patient's dress, the patient station being adapted for analyzing the measured patient data, and the patient station being adapted for providing

feedback information to the patient by means of a knowledge-based system, which feedback information is based on the measured patient data.

The object of the present invention is also achieved by a method of monitoring a patient, comprising the steps of measuring patient data by means of a number of sensors linked to a patient station, said sensors being integrated into a patient carrier and/or a patient's dress, analyzing the measured patient data by means of the patient station, and providing feedback information to the patient by means of the patient station using a knowledge-based system, which feedback information is based on the measured patient data.

The object of the present invention is also achieved by a computer program comprising computer instructions for analyzing patient data measured by means of a number of sensors linked to a patient station, the number of sensors being integrated into a patient carrier and/or a patient's dress, and further comprising computer instructions for providing feedback information from the patient station to the patient using a knowledge-based system, which feedback information is based on the measured patient data, when the computer program is executed on a computer. The technical effects necessary according to the invention can thus be realized on the basis of the instructions of the computer program in accordance with the invention. Such a computer program may be stored on a carrier such as a CD-ROM or it may be made available over the Internet or some other computer network. Prior to being executed, the computer program is loaded into the computer, i.e. is read from the carrier, for example by means of a CD-ROM player, or from the Internet, and is stored in the memory of the computer. The computer includes inter alia a central processing unit (CPU), a bus system, memory means, e. g. RAM or ROM, storage means, e. g. floppy disk or hard disk units, and input/output units.

A basic idea of the present invention is, besides monitoring of the patient (e.g. the cardiopulmonary performance of the patient), also to manage the patient's disease (e.g. the cardiac disease) by providing feedback information to the patient by means of a knowledge-based system, which feedback information is based on the measured patient data. In this context, it is another advantage of the present invention that part of the care received by the patients during their hospital stay is brought to their

homes. It is known from studies of care by nurses that a continuous surveillance of the relevant parameters in the case of CHF (congestive heart failure) patients leads to a drastic reduction in readmissions to hospitals and to a reduction in patient mortality. The same effect is expected from the present invention. In other words, the present invention suggests a patient monitoring system which is adapted for working as a CHF management system, in particular for home use.

The information to be provided to the patient is generated by a knowledge-based system. The term "knowledge-based system" describes a software program for querying a special knowledge base (database). Another term to describe such a software program is "expert system". An expert system is an artificial intelligence application that uses a knowledge base of human expertise as an aid in solving problems. The degree of problem solving is based on the quality of the data and rules obtained from the human expert. The expert system derives its answers by running the knowledge base through an inference engine, a software program that interacts with the user and processes the results from the rules and data in the knowledge base. For example, an optimum medication is calaculated by a knowledge based system in which best medical practices, state of research, and regulations are reflected. The knowledge-based system is preferably implemented as a computer program executed on a computer within the patient station. Alternatively, the knowledge-based system is implemented as a remote system to which the patient station connects autonomously.

These and other aspects of the invention will be further elaborated on the basis of the following embodiments, which are defined in the dependent claims.

For an optimum care of a patient, particularly in the case of monitoring of the patient's cardiopulmonary performance, it is mandatory to have available a reproducible measurement of the patient's weight and heart rate. Further important parameters are pulmonary activity, bio-impedance, heart stroke volume, or a diagnostic ECG, etc.

In a preferred embodiment of the invention, therefore, it is suggested to use multiple kinds of sensors, e.g. a sensor for measuring the patient's weight and/or a sensor for measuring the patient's heart rate and/or a sensor for measuring the patient's

pulmonary activity and/or a sensor for measuring the patient's bio-impedance and/or a sensor for measuring the patient's heart stroke volume and/or a sensor for measuring the patient's ECG signals and/or a sensor for measuring the patient's position and/or a sensor for measuring the patient's fluid retention. The type of sensor can be chosen in dependence on the desired information about the patient's condition.

The sensors are integrated into the patient's dress and/or a carrier. A carrier according to the present invention is defined as a surface or any other device for the patient to rest on or to sit on, etc., e.g. a conventional bed, a hospital bed, a couch, a conventional chair, a dentist's chair, a wheelchair, an (operating) table, etc.

The measured patient data is preferably transferred from the sensors to the patient station via a wireless link, enabling a free arrangement of the number of sensors at the bedside without cables.

The patient device is adapted for giving feedback information, which information preferably comprises a change in medication and/or advice to seek contact with a medical professional or recommendations on physical activity or diet.

In another embodiment of the invention, the patient station allows the patient to interact with the system and/or to control the system where appropriate, e.g. by giving an input according to a personal health management plan (like diet or activity). For this purpose, the patient station is preferably adapted for receiving direct patient input, e.g. by using a voice entry system or a manual input system such as pressing buttons, using a keyboard, etc. If such an interaction is not desired, patient station and bed are designed to work autonomously, without any external trigger or patient interaction. Interaction with the monitoring system may also be implemented with e.g. an activity monitor, for example a patient-worn device, such as a belt or some other mobile device, which generates input signals for the monitoring system.

Preferably, the patient station is adapted for controlling the measuring process, e.g. for controlling the type and frequency of measurements. For this purpose, the patient station is adapted for evaluating the measured patient data with appropriate algorithms.

In yet another embodiment of the invention, the patient station is connectable to an external device and/or an external network, e.g. to provide a more

convenient maintenance, data storage, and features like online visits and more. Preferably, the patient data are transferred routinely to a server, and the hospital and/or a GP are supplied with the necessary data upon demand or in any emergency situation. Any change in medication or other feedback given to the patient may also be included in an online consultation with a GP or some other kind of suitable medical service, as required, e.g. by legal restrictions. The knowledge based system may also be provided externally.

These and other aspects of the invention will be described in detail hereinafter, by way of example, with reference to the following embodiments and the accompanying drawings; in which the sole Figure is a schematic block diagram showing a patient monitoring system according to the invention.

The patient monitoring system 100 comprises a patient station 10 linked to a front end 11. The front end 11 comprises a number of sensors 12 for measuring patient data. These desired parameters are sensed by a combination of different sensors integrated into the bed and/or the patient's (night) clothes. According to the invention, multiple kinds of sensors 12 are used, e.g. a sensor for measuring the patient's weight (e. g. a piezoelectric or strain gauge sensor) and/or a sensor for measuring the patient's heart rate (e.g. a suitable piezoelectric, bio-impedance, or inductive sensor) and/or a sensor for measuring the patient's pulmonary activity and/or a sensor for measuring the patient's bio-impedance (e.g. by capacitive sensing) and/or a sensor for measuring the patient's heart stroke volume (e.g. by inductive sensing) and/or a sensor for measuring the patient's ECG signals (e.g. by electrode sensing or by capacitive sensing) and/or a sensor for measuring the patient's position or activity (e.g. a suitable piezoelectric, capacitive, or inductive sensor) and/or a sensor for measuring the patient's fluid retention (e.g. a suitable bio-impedance or inductive sensor) and/or a sensor for measuring the patient's breathing or breathing rate (e.g. by capacitive sensing). All sensors 12 can be integrated into the mattress or bed sheet or the bedstead or attached to the bed. Alternatively, they may be integrated into the patient's dress. A scale may also be integrated into a bed post.

Textile sensors are preferably used for integration into the mattress or bed sheets. A washable textile or foam mat carrier is used for the sensors, having

typical dimensions of 800x2000 mm. Furthermore, leads, electronics and cables are provided. Textile sensors suitable for 24/7 usage are preferred.

Soft sensors and/or hard sensors may be used for carrying out the measurements. Typical hard sensors are strain gauge pucks used for bed post weight measurements. Such sensors are capable of carrying out weight measurements from typically 50 g to 500 kg with a resolution of 20 g and a reproducibility of less than 0.2 %. Other hard sensors are non-textile coils, e.g. integrated into the bed, for inductive measurements.

Various kinds of soft sensors are used, e.g. soft sensors for inductive measurements and piezoelectric sensors. Textile inductors (coils) in a carrier, such as a sleeping gown, are used as sensors for inductive measurements. The inductor serves as a transmitter and receiver. A typical resonant frequency is around 10 MHz. Electrode structures are used for capacitive sensing, e.g. for a capacitive read-out of electrical signals, as well as for the sensing of body position and movement, e.g. respiration.

Conducting, dry textile areas are use as sensors for bio-impedance measurements. An array of different electrodes is preferably used to obtain different measurement positions. Measurements at varying positions of the body are carried out with electrodes in a sheet-like carrier providing direct skin-contact. At least four electrodes are needed for such a measurement.

Other conducting, dry textile areas are used as ECG electrodes. Preferably, an array of different electrodes is used to obtain different measurement positions. Measurements at varying positions of the body are carried out with electrodes in a sheet-like carrier providing direct skin-contact. An example of such an ECG electrode arrangement may be a pillow as one electrode and a foot area as another electrode.

A first example of a sensor layout includes soft sensors for bio-impedance measurements and multiple soft ECG electrodes integrated into the bed sheet for carrying out measurements of the thorax. The same arrangement may be used for bio-impedance and ECG measurements in the region of the patient's legs, possibly using smaller contacts. Ideal would be a matrix of (small) contacts, such that optimum contacts can be selected "dynamically". It is also possible to have one large ECG

contact in the lower leg area.

A second example of a sensor layout again includes soft sensors for bio-impedance measurement and multiple soft ECG electrodes integrated into the bed sheet for carrying out measurements of the thorax. Additionally, the patient wears pajamas comprising through contacts integrated into shirt and trousers.

A third example of a sensor layout includes a hard non-contact sensor integrated into the mattress for carrying out an inductive measurement.

A fourth example of a sensor layout includes sensors for carrying out a capacitive measurement with or without counter-electrodes. The sensors may be realized as soft sensors in the form of textile structures (e.g. bed sheet) or as hard sensors integrated into the mattress, bedstead or an intermediate device, such as an sleeping pad. Of course, soft sensors and hard sensors may be combined in any configuration in order to obtain a sensor arrangement which best fits the measuring situation.

The measured patient data is transferred in a first step from the sensors 12 to a bedside multi-channel acquisition unit 13. The acquisition unit 13 is part of the front end 11. The front end 11 comprises a computer 14 adapted for executing a front end software. The front end software controls the front end 11 in a way that enables different main conditions (states). In a “sleep” state the front end 11 is shut down for zero power consumption. In a “standby” state the front end 11 is ready to receive and send patient data or other signals, e.g. internal control or status signals, to the patient station 10. In a “ready for measurement” state the front end 11 is ready for measurement and in a “measurement” state the front end 11 is measuring sensed data. In a “send data” state the front end 11 sends data to the patient station 10, where it is stored. Additionally, a “bad signal detection” algorithm is implemented in the front end software for testing the measured signal quality. Given data, it assigns a “good”/”bad” label to the data. If the data is classified as “bad”, it must be discarded, and a fresh measurement must be taken.

Data transfer from the sensors 12 to the acquisition unit 14 and from the front end 11 to the patient station 10 is carried out over a wireless data communication link 15 using the Bluetooth technique and the TCP/IP data transfer protocol. Preferably,

the link 15 allows bi-directional communication within a range of up to 10 m. Accordingly, both the front end 11 and the patient station 10 comprise a communication interface 16 adapted to carry out the data transfer as described. Alternatively, the data communication links may be (partly) implemented as wires, e.g. with USB connections.

During all parts of the monitoring procedure as described above, an error handling procedure is installed, in which all error handling steps are logged. In general, if a step could not be successfully carried out, several repeat attempts are carried out. If the error cannot be rectified, the patient and/or GP and/or hospital is notified (e.g. via a window on a monitor of the patient station 10 and/or the server).

The operator of the patient station 10 may be the patient himself or a carer, e.g. spouse or nurse. This person will be called patient in the following for simplicity's sake. The patient station 10 is the interface between the patient and the patient monitoring system 100. It can also be used when the patient interacts with medical professionals.

The initial measuring procedure is as follows: If no patient is in the bed, the "sleep" state is activated. The measurement procedure starts when a patient enters the bed. First the patient's weight is measured. The measured data is compared with former weight measurements by the patient station 10 (e.g. by means of a suitable computer program executed in the patient station's computer 17). If the patient is recognized, his/her position is sensed by appropriate sensors 12. Depending on the patient's position, a measurement sequence is started or not. Finally, an acoustic feedback is given to the patient. The feedback comprises instructions for the patient for optimizing the patient's position before sleep. During sleep relevant parameter are measured and transferred to the patient station 10.

In other words, the patient station 10 is adapted to record the relevant data automatically. The patient station 10 detects a person entering the bed (trigger condition), stores the data, and allows the patient to view data. The patient will also be allowed to administer relevant parameters (e.g. nutrition intake). The patient station 10 controls the complete measurement procedure. Furthermore, the patient station controls automated alarm procedures to alert the patient, GP, or hospital. A data transfer to the GP or hospital and to a server station will automatically run on the patient station 10, if

so desired. The patient station 10 is adapted to give medication recommendations directly to the patient and to report these, as well as an acknowledgement thereof from the patient, to the server and the GP. The system comprising the patient station / front end electronics / bed sensors works autonomously with no interaction from patient, GP, or hospital required (indicated by a dashed line). To implement all these functions, the patient station 10 comprises a computer 17 and a suitable computer program adapted to be executed on the computer 17.

The patient station 10, which may be a PC type device, laptop, PDA, TV set (including a set top box), or the like, includes a data storage module 18 adapted for storing received measuring data. Furthermore, the patient station 10 comprises appropriate electronics (amplifier, filter, multiplexer, etc.). The patient station 10 further comprises an analyzing module for analyzing the measured patient data. The computer 17 is adapted to work as an analyzing module in the present embodiment. The computer 17 is adapted to execute a suitable computer program for analyzing patient data. Analysis of the measured patient data and/or control of the measuring procedure and/or generation of medication recommendations or other recommendations for the patient is carried out by the patient station 10, which uses a knowledge-based system 19 for this. The knowledge-based system 19 uses a knowledge base (not shown), in which normal ranges are set for all relevant parameters, either in a general way or individually for each patient as provided by the GP or hospital (e.g. resting pulse rate between 70 and 90 bpm). Standard values as defined by the European Cardiac Society may be used for this purpose. If the monitoring system 100 determines a value outside the normal range, a feedback is provided to the patient, and/or the GP or hospital will be informed. The content of the feedback, e.g. regarding medication, is provided by the knowledge-based system 19.

The patient station 10 is adapted for giving feedback information to the patient, the feedback information being based on the measured patient data. Furthermore, the patient station 10 allows the patient to interact with the system 100 and/or to control the system 100 where appropriate. A patient user interface 20 is provided for this purpose. The patient user interface 20 comprises a touch screen and/or a PDA and/or a laptop and/or a personal computer and/or a TV set. In addition, the

patient user interface is adapted to give feedback to the patient, e.g. by means of a speaker, a monitor, etc.

The patient station 10 is adapted so as to provide the following kinds of user messages: hints on an optimum measurement position, medication recommendations, medication reminders, advice to contact the GP, alarm signals, guidance through calibrating procedures, asking for user/GP input.

The patient station 10 is adapted to accept the following (partly optional) user inputs (apart from the standard measurement routine): input during calibration, changes in medication (with confirmation), input arising from questionnaires filled in at regular intervals (self-assessment), input from GP/hospital.

The patient station 10 is connectable to an external network comprising a server 21, a GP/hospital station 22, and a service station 23 (technical or maintenance station). Data transfer from the patient station 10 to the server 21 and the GP/hospital station 22 is carried out via a communication link 24 using a GSM system (cellular phone). The external devices 21, 22, 23 are connected to each other by means of a (computer) network using an Ethernet communication link 25, i.e. the data transfer between the external devices is based on the TCP/IP data transfer protocol. The patient station 10, the server 21, and the GP/hospital station 22 each comprise a GSM communication interface 26 for this purpose. Furthermore, the server 21, GP/hospital station 22, and service station 23 each comprise an Ethernet communication interface 27.

The communication between patient station 10 and server 21 involves different protocols: “regular data transfer”, “maintenance data transfer” and “alarm”. During a regular data transfer, which is carried out daily, measurement data are transferred to the server 21 for storage in a server database 28 and backup. The data can be accessed from the GP/hospital station 22 and from the patient station 10 when triggered manually for diagnosis and/or evaluation and/or feedback. During maintenance data transfer, which is preferably triggered by a technician, changes in the measuring procedures or alarm trigger values are applied, mainly in case of software updates. During alarm, which is triggered automatically by the patient station software if one ore more of the measured patient data exceeds a predefined limit value,

measurement data is transferred to the server together with a reason for the alarm. An alarm confirmation by GP and/or hospital is also stored on the server 21. Errors are handled as described above.

The communication between patient station 10 and GP/hospital station 22 involves different protocols: "consultation", "information", and "alarm". In the consultation protocol, which is triggered by GP and/or patient, both parties log into the server database 28. Patient and doctor can see the same desktop and talk by (hands-free) phone. In the information protocol, which is triggered automatically, information on recommended changes in medication is given to the GP. A confirmation can be given by the GP before information is transferred to patient. For this purpose, the GP/hospital station 22 comprises a user interface 29. In the alarm protocol, which is triggered automatically, measurement data and the reason for the alarm are transferred to the server 21 and the GP station 22. A confirmation by GP and/or hospital is also stored on the server 21. Errors are again handled as described above.

All patient data is transferred to the server 21. The server 21 provides a web-based interface to access, show, and edit the patient data via the GP/hospital station 22 and to show data on the patient station 10. An additional service station 23 enables system maintenance and data download, but does not allow changing of patient-related data.

The server 21 provides the following functions: data management, data filing, control data access, binary data storage, and backup. Furthermore, the server 21 provides a patient management system by providing a patient database 28 and a web interface or client server application for GP access to the patient database 28. In addition, changes in patient data are logged. The server 21 also provides an automatic call handling, i.e. handles parallel incoming calls and enables an automatic data exchange with the patient station 10.

The patient data and measurement data are stored in a database 28. Access to the database 28 is made available to the patient stations 10 and GP/hospital stations 22. The database 28 and the database software are so adapted that it is guaranteed that only one GP can process a particular patient at a given time, thus avoiding multiple diagnoses and extra work for the doctors. It also guarantees that all

access to patient data can be logged, and that data or analyses cannot be accidentally deleted.

The data on the server 21, and especially the patient data in database 28, are protected against data losses. Daily backups and physically redundant data storage are mandatory. Furthermore, the database 28 is maintained on parallel RAID systems, thus minimizing the risk of data losses and downtime owing to hard disk drive failure. A backup of the database 28 is made every night at a fixed time. The data is stored on the patient station 10 for at least 24 hours, allowing possible reloading of lost data.

A firewall is installed for protecting the database 28 against hacker attacks, i.e. access is allowed only through ports necessary for the patient station and GP station communication. Moreover, connections are allowed only to devices that have telephone numbers present in a list of allowed telephone numbers (i.e. the telephone numbers of the patient stations and the GP stations). This is achieved by means of the appropriate internal telecom configuration, if possible. A manual check of the incoming call telephone number (via CLIP) before allowing access would require a modification of a standard data transfer protocol, introducing possible errors. In order to protect patient-related data, additional measures are taken to provide a high level of data integrity, data security, and data protection.

Error alarms are provided for handling errors that occur during the operation of the patient monitoring system 100. The appropriate people are informed when problems arise, e.g. by SMS, e-mail, or telephone call. As an immediate delivery of SMS or e-mails cannot be guaranteed, the person responsible must be notified by telephone in the case of severe problems. Possible trigger conditions for generating an error alarm are: patient station has not measured data (this has been determined if patient station has contacted server to pass on this information), patient station 10 has measured data but data transfer unsuccessful, patient station 10 has tried to measure data and was unsuccessful, no contact possible to patient station 10 (this has been determined by passing through the database and checking records from all patients), failure of server hardware, database backup not possible, server 21 has crashed, or hard disk failure. Additionally, an independent process is run on the patient station 10 that pings the server 21 regularly to detect when the server 21 is down.

The GP/hospital station 22 provides the following functions: the GP station allows access to the patient data stored on the server 21 for evaluation. Patient data can be entered/changed only via the GP station 22. In the case of alerts or alarms, GP and patient are triggered to connect to the server 21. The GP/hospital station 22 comprises a GP user interface 29, e.g. a PC or laptop. If a new patient is to be added, a new data base entry can be generated through the GP user interface 29. The following data can be checked on the GP/hospital station 22: notification of alerts and alarms, notification of changes in medication status, show medication status, view/edit patient data, confirm/reject automatic diagnoses.

The service station 23 is used for database management and for software and procedure management. The service station 23 provides the following functions: database administration tasks, patient database check (e.g. generation of statistics), server functionality check; distribution of software (to GP/server/patient station). Using the technician user interface 30, e.g. in form of a PC or laptop, the following actions can be carried out: read access to all anonymous entries in the database (i.e. no access to personal data), software management, and database management.

All computers may be implemented as PC type computers. However, they are preferably implemented as small microprocessors or microcontrollers or the like set in an appropriate working environment in order to fit into small patient-related or bed-related devices.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. It will furthermore be evident that the word "comprising" does not exclude other elements or steps, that the words "a" or "an" does not exclude a plurality, and that a single element, such as a computer system or another unit, may fulfil the functions of several means recited in the claims. Any reference signs in the

claims shall not be construed as limiting the claim concerned.

REFERENCE LIST

10 patient station
11 front end
12 sensor
13 acquisition unit
14 computer
15 communication link
16 communication interface
17 computer
18 data storage module
19 knowledge-based system
20 patient user interface
21 server
22 GP/hospital station
23 service station
24 communication link
25 communication link
26 GSM communication interface
27 Ethernet communication interface
28 database
29 GP user interface
30 technician user interface

CLAIMS:

1. A patient monitoring system (100) comprising a patient station (10), the patient station (10) being linked to a number of sensors (12) for measuring patient data, the number of sensors (12) being integrated into a patient carrier and/or a patient's dress, the patient station (10) being adapted for analyzing the measured patient data, and the patient station (10) being adapted for providing feedback information to the patient by means of a knowledge based system (19), which feedback information is based on the measured patient data.

2. The patient monitoring system (100) as claimed in claim 1, wherein said number of sensors (12) comprises a sensor for measuring the patient's weight and/or a sensor for measuring the patient's heart rate and/or a sensor for measuring the patient's pulmonary activity and/or a sensor for measuring the patient's bio-impedance and/or a sensor for measuring the patient's heart stroke volume and/or a sensor for measuring the patient's ECG signals and/or a sensor for measuring the patient's position and/or a sensor for measuring the patient's fluid retention.

3. The patient monitoring system (100) as claimed in claim 1, wherein the link (15) between the patient station (10) and at least one of said number of sensors (12) is a wireless link.

4. The patient monitoring system (100) as claimed in claim 1, wherein the feedback information comprises a change in medication and/or a diet or sports recommendation and/or an advice to seek contact with a medical professional.

5. The patient monitoring system (100) as claimed in claim 1, wherein the patient station (10) is adapted for receiving direct patient input, enabling the patient to

interact with the patient station (10).

6. The patient monitoring system (100) as claimed in claim 1, wherein the patient station (10) is adapted for controlling the measuring process.

7. The patient monitoring system (100) as claimed in claim 1, wherein the patient station (10) is connectable to an external device and/or an external network.

8. The patient monitoring system (100) as claimed in claim 7, further comprising an external server (21) and/or an external GP/hospital station (22) and/or an external service station (23) directly or indirectly connectable to the patient station (10).

9. A method of monitoring a patient, comprising the steps of

- measuring patient data by means of a number of sensors (12) linked to a patient station (10), said sensors (12) being integrated into a patient carrier and/or a patient's dress,

- analyzing the measured patient data by means of the patient station (10),

- providing feedback information to the patient by means of the patient station (10) using a knowledge-based system (19), which feedback information is based on the measured patient data.

10. A computer program,

- comprising computer instructions for analyzing patient data measured by means of a number of sensors (12) linked to a patient station (10), the number of sensors (12) being integrated into a patient carrier and/or a patient's dress, and

- comprising computer instructions for providing feedback information from the patient station (10) to the patient by means of a knowledge-based system (19), the feedback information being based on the measured patient data,

when the computer program is executed in a computer (17).

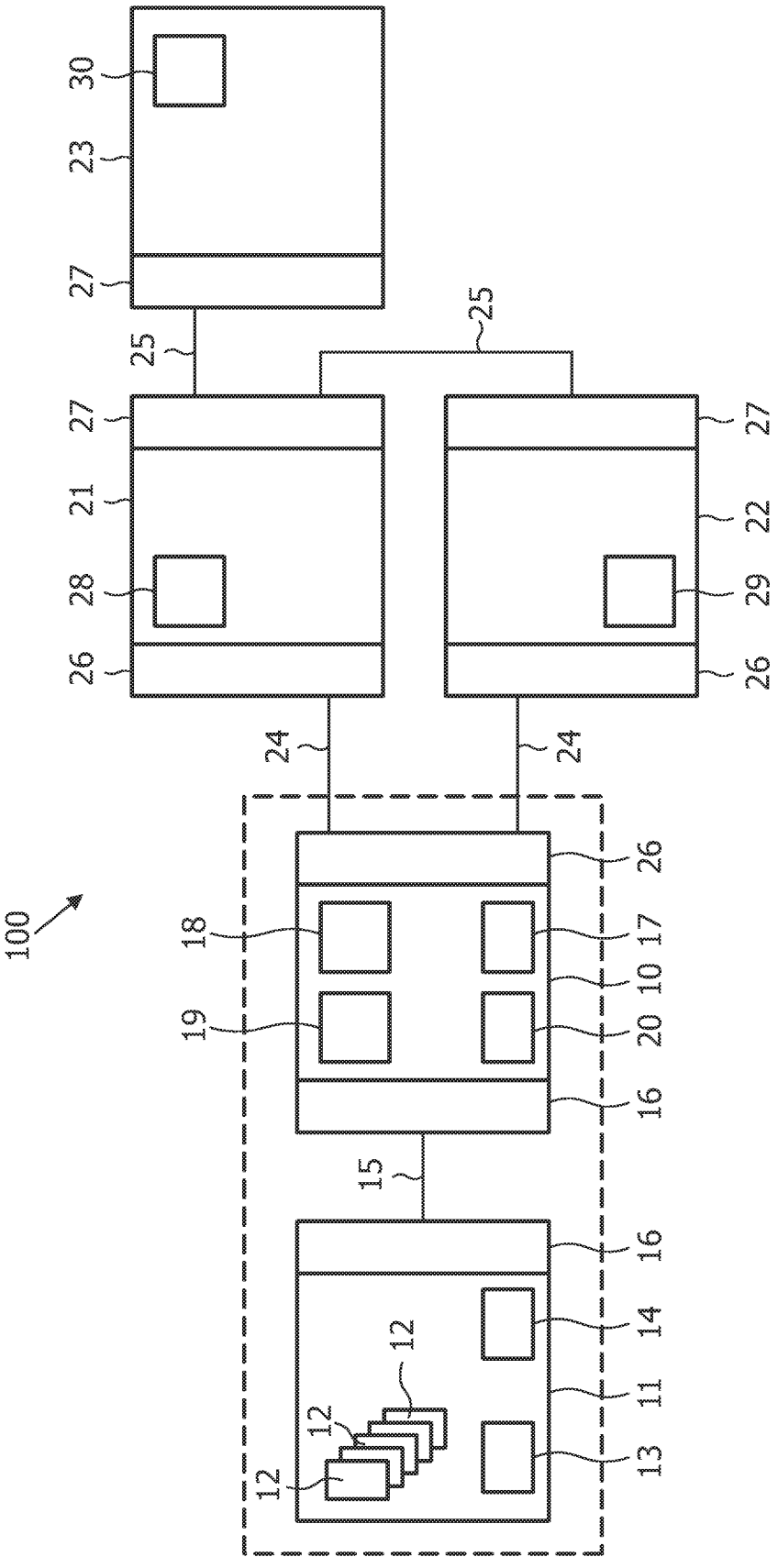
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FIG. 1

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/051044

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/060380 A (HEALTHETEC, INC; MAULT, JAMES, R) 8 August 2002 (2002-08-08) page 3, line 13 - line 17 page 5, line 7 - line 9 page 7, line 21 - line 22 page 8, line 20 - line 24 claims 1,8,9	1-10
X	WO 01/78577 A (VIVOMETRICS, INC) 25 October 2001 (2001-10-25) page 6, line 29 - page 8, line 26 page 30, line 7 - line 11	1-10
X	US 2002/107433 A1 (MAULT JAMES R) 8 August 2002 (2002-08-08) paragraphs [0068], [0070], [0074], [0090]	1-10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 July 2006	08/08/2006

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2006/051044

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/208113 A1 (MAULT JAMES R ET AL) 6 November 2003 (2003-11-06) paragraphs [0034], [0076], [0079], [0148]	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2006/051044

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 02060380 A	08-08-2002	NONE	
WO 0178577 A	25-10-2001	AU 5359901 A	30-10-2001
		CA 2405848 A1	25-10-2001
		EP 1296591 A2	02-04-2003
		JP 2003530184 T	14-10-2003
US 2002107433 A1	08-08-2002	NONE	
US 2003208113 A1	06-11-2003	NONE	

专利名称(译)	病人监护系统		
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申请号	EP2006727839	申请日	2006-04-05
[标]申请(专利权)人(译)	皇家飞利浦电子股份有限公司		
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当前申请(专利权)人(译)	飞利浦知识产权及标准部GMBH 皇家飞利浦电子N.V.		
[标]发明人	BRAUERS ANDREAS REITER HARALD MUEHLSTEFF JENS SUCH OLAF		
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优先权	2005103174 2005-04-20 EP		
外部链接	Espacenet		

摘要(译)

本发明涉及患者监测系统，监测患者的方法和计算机程序。为了改善患者的监测，特别是用于监测心肺功能，建议患者监测系统（100）包括连接到多个传感器（12）的患者站（10），用于测量患者数据，传感器的数量（12）被整合到患者载体和/或患者的衣服中，患者站（10）适于分析测量的患者数据，并且患者站（10）适于通过以下方式向患者提供反馈信息：在基于知识的系统（19）中，反馈信息基于测量的患者数据。本发明提出了一种患者监测系统（100），其适于作为CHF管理系统工作，特别是用于家庭使用。