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(54) **SYSTEMS AND METHODS FOR REMOTE MONITORING OF PATIENT TREATMENT**

(71) Applicants: **WILLIAM B. CRIBBS**, MORRO BAY, CA (US); **ARNOLD RUGAMA**, FRESNO, CA (US)

(72) Inventors: **WILLIAM B. CRIBBS**, MORRO BAY, CA (US); **ARNOLD RUGAMA**, FRESNO, CA (US)

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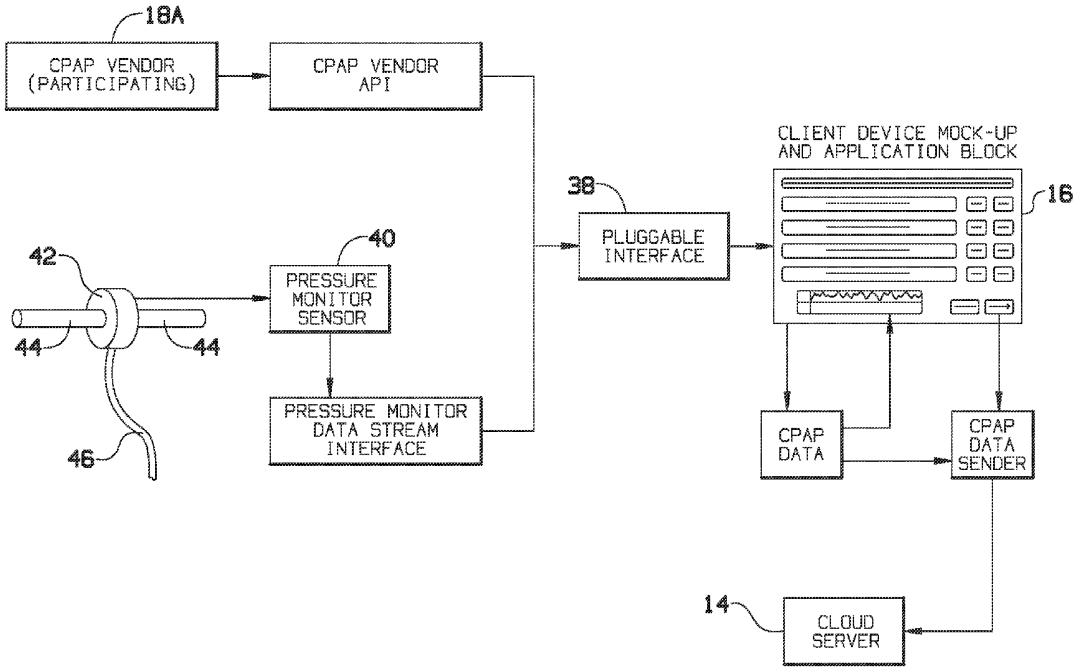
USPC **600/529**; 705/2

(57) **ABSTRACT**

Systems and methods for remote monitoring of patient treatment are disclosed. A medical device may transmit telemetry directly to a patient terminal, or the medical device may be retrofitted with instrumentation for the patient terminal to collect telemetry. The patient terminal may collect patient self-reporting data. The telemetry and the self-reporting data may be sent to a cloud server, which may store the patient data. The patient data may be used to generate an alert, or it may be sent to a doctor terminal for display and review.



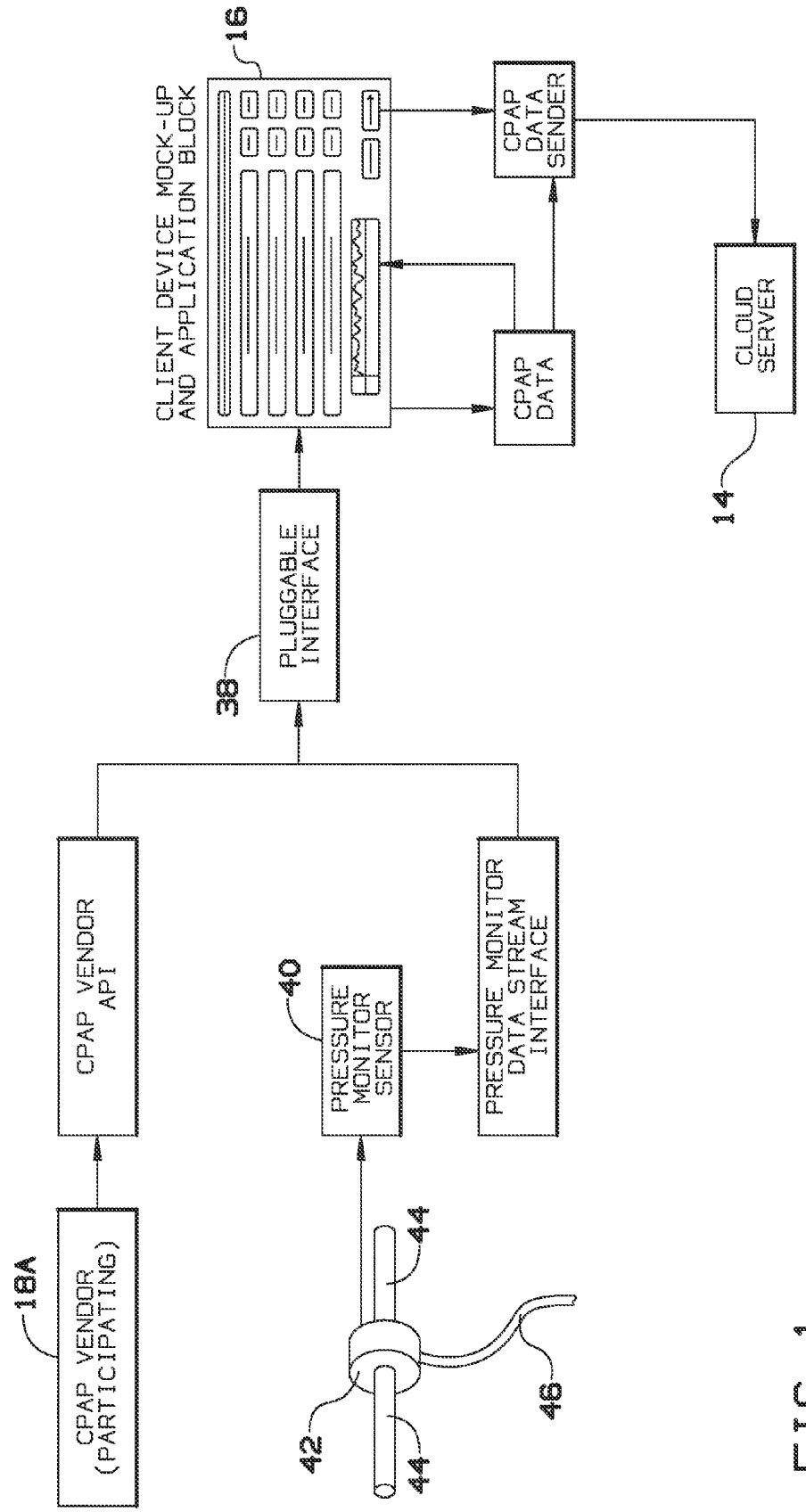

16
CLIENT DEVICE MOCK-UP AND APPLICATION BLOCK
CPAP DATA SENDER
CPAP DATA
CLOUD SERVER
14
38
PLUGGABLE INTERFACE
CPAP VENDOR API
40
PRESSURE MONITOR SENSOR
PRESSURE MONITOR DATA STREAM INTERFACE
18A
CPAP VENDOR (PARTICIPATING)
42
44
44
46

FIG. 1

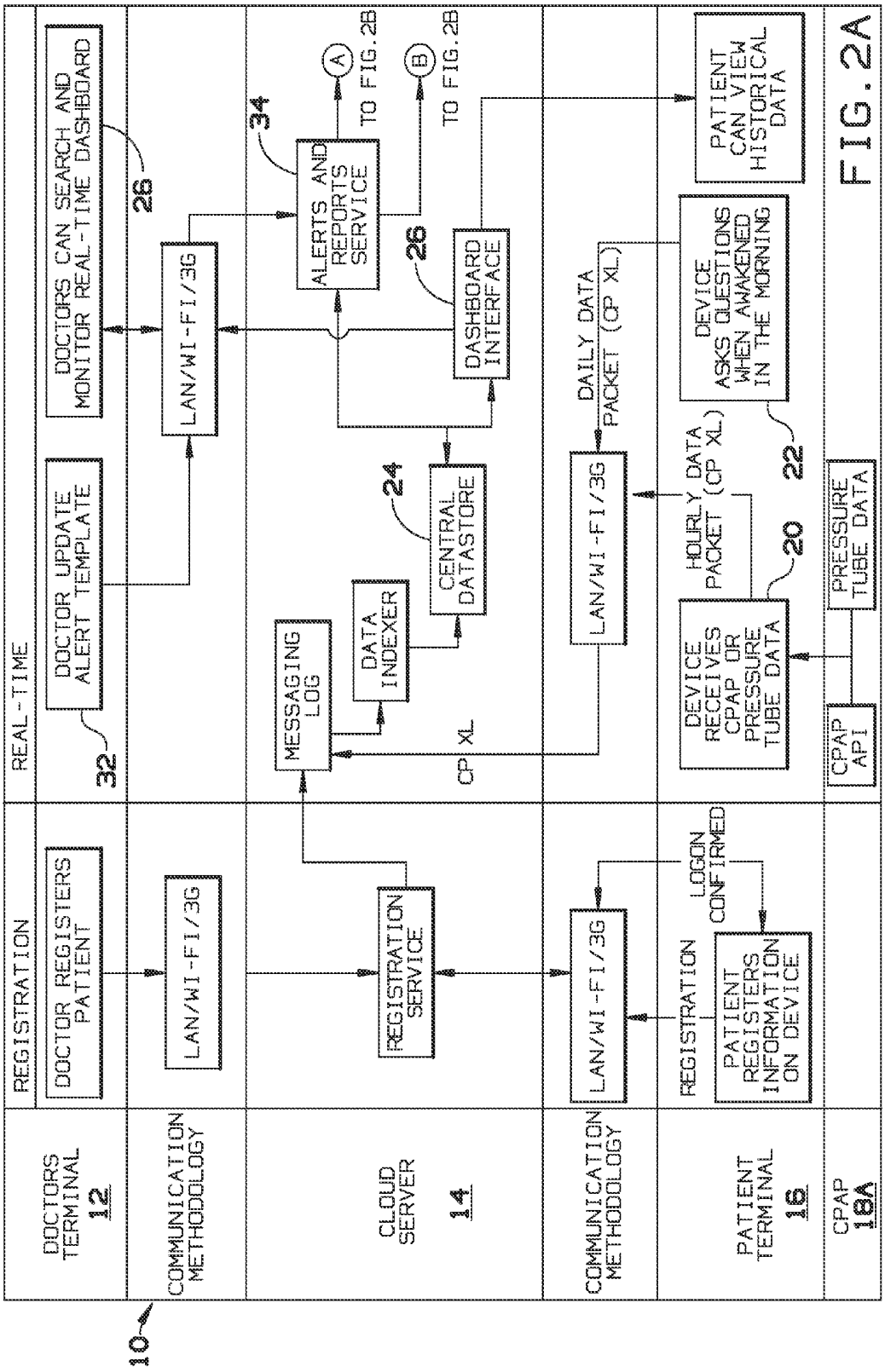

10
DOCTORS TERMINAL 12
COMMUNICATION METHODOLOGY
CLOUD SERVER 14
COMMUNICATION METHODOLOGY
PATIENT TERMINAL 16
CPAP 18A
REGISTRATION
REAL-TIME
DOCTOR REGISTERS PATIENT
LAN/WI-FI/3G
REGISTRATION SERVICE
LAN/WI-FI/3G
REGISTRATION
PATIENT REGISTERS INFORMATION ON DEVICE
LOGON CONFIRMED
DOCTOR UPDATE ALERT TEMPLATE
32
LAN/WI-FI/3G
26
DOCTORS CAN SEARCH AND MONITOR REAL-TIME DASHBOARD
MESSAGING LOG
DATA INDEXER
24
CENTRAL DATASTORE
CP XL
34
ALERTS AND REPORTS SERVICE
A
TO FIG. 2B
B
TO FIG. 2B
26
DASHBOARD INTERFACE
LAN/WI-FI/3G
DAILY DATA PACKET (CP XL)
HOURLY DATA PACKET (CP XL)
20
DEVICE RECEIVES CPAP OR PRESSURE TUBE DATA
DEVICE ASKS QUESTIONS WHEN AWAKENED IN THE MORNING
22
PATIENT CAN VIEW HISTORICAL DATA
CPAP API
PRESSURE TUBE DATA

FIG. 2A

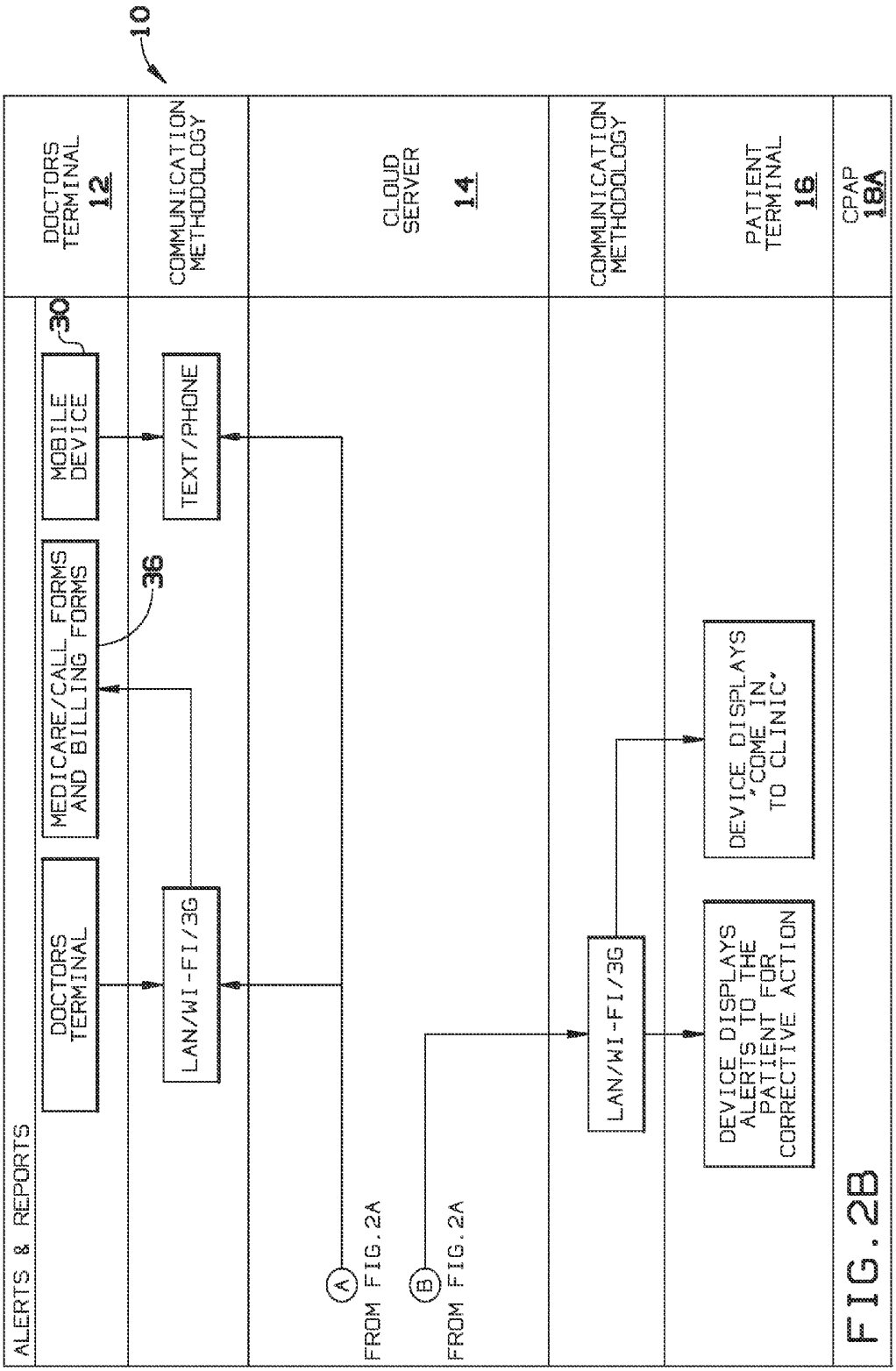

10
DOCTORS TERMINAL 12
COMMUNICATION METHODOLOGY
CLOUD SERVER 14
COMMUNICATION METHODOLOGY
PATIENT TERMINAL 16
CPAP 18A
ALERTS & REPORTS
DOCTORS TERMINAL
MEDICARE/CALL FORMS AND BILLING FORMS
36
MOBILE DEVICE
30
LAN/WI-FI/3G
TEXT/PHONE
FROM FIG. 2A
A
FROM FIG. 2A
B
LAN/WI-FI/3G
DEVICE DISPLAYS ALERTS TO THE PATIENT FOR CORRECTIVE ACTION
DEVICE DISPLAYS "COME IN TO CLINIC"

FIG. 2B

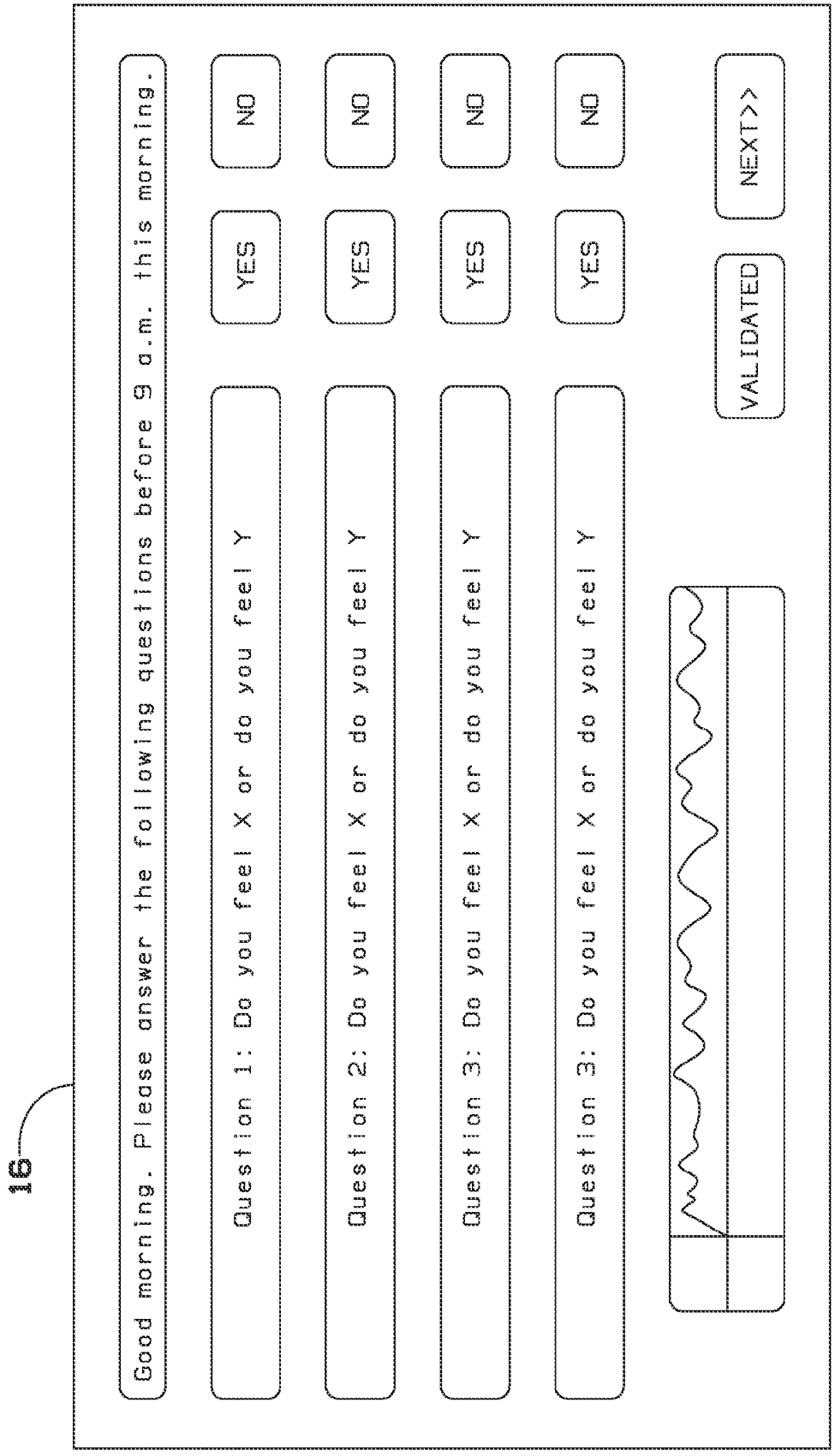

16
Good morning. Please answer the following questions before 9 a.m. this morning.
Question 1: Do you feel X or do you feel Y
YES
NO
Question 2: Do you feel X or do you feel Y
YES
NO
Question 3: Do you feel X or do you feel Y
YES
NO
Question 3: Do you feel X or do you feel Y
YES
NO
VALIDATED
NEXT>>

FIG. 3

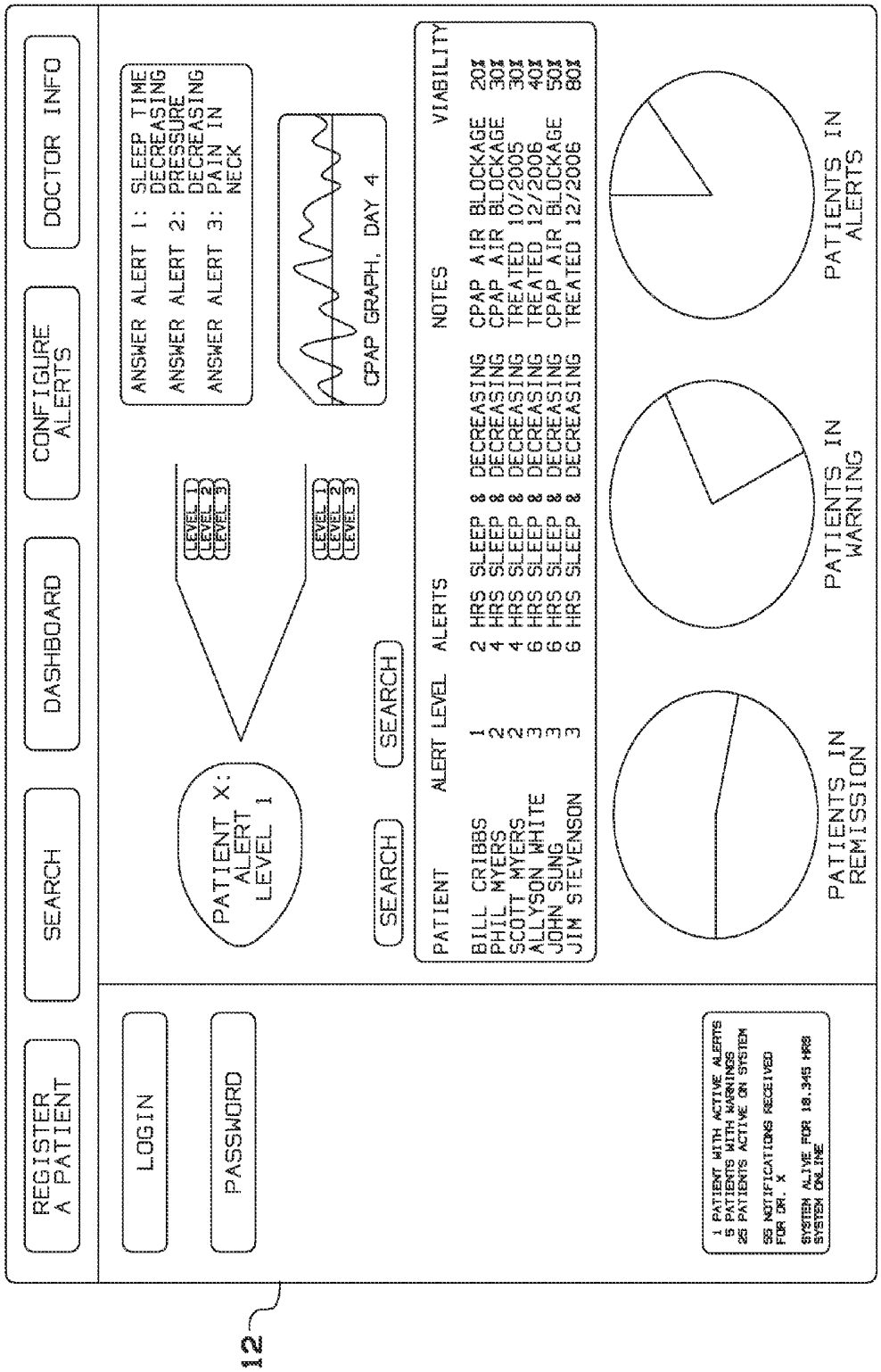

REGISTER A PATIENT
SEARCH
DASHBOARD
CONFIGURE ALERTS
DOCTOR INFO
LOGIN
PASSWORD
1 PATIENT WITH ACTIVE ALERTS
5 PATIENTS WITH WARNINGS
25 PATIENTS ACTIVE ON SYSTEM
95 NOTIFICATIONS RECEIVED FOR DR. X
SYSTEM ALIVE FOR 18.345 HRS
SYSTEM ONLINE
PATIENT X: ALERT LEVEL 1
LEVEL 1
LEVEL 2
LEVEL 3
LEVEL 1
LEVEL 2
LEVEL 3
SEARCH
SEARCH
ANSWER ALERT 1: SLEEP TIME DECREASING
ANSWER ALERT 2: PRESSURE DECREASING
ANSWER ALERT 3: PAIN IN NECK
CPAP GRAPH, DAY 4
PATIENT ALERT LEVEL ALERTS NOTES VIABILITY
BILL CRIBBS 1 2 HRS SLEEP & DECREASING CPAP AIR BLOCKAGE 20%
PHIL MYERS 2 4 HRS SLEEP & DECREASING CPAP AIR BLOCKAGE 30%
SCOTT MYERS 2 4 HRS SLEEP & DECREASING TREATED 10/2005 30%
ALLYSON WHITE 3 6 HRS SLEEP & DECREASING TREATED 12/2006 40%
JOHN SUNG 3 6 HRS SLEEP & DECREASING CPAP AIR BLOCKAGE 50%
JIM STEVENSON 3 6 HRS SLEEP & DECREASING TREATED 12/2006 80%
PATIENTS IN REMISSION
PATIENTS IN WARNING
PATIENTS IN ALERTS
12

FIG. 4

SYSTEMS AND METHODS FOR REMOTE MONITORING OF PATIENT TREATMENT

BACKGROUND

[0001] The embodiments herein relate generally to systems and methods for the remote monitoring of patient treatment, including gathering medical device telemetry and patient self-assessment data.

[0002] Currently, a physician is not able to accurately and regularly monitor a patient while the patient is at home. Current methods of home monitoring, including, e.g., calling, device logs, office visits, and so on, do not provide effective, timely, or efficient information to the responsible physician. Inaccurate or incomplete monitoring presents challenges to the physician in terms of making a diagnosis, determining treatment effectiveness, determining patient compliance, completing medical paperwork, and other areas.

[0003] Some current medical devices provide some telemetry, such as when devices are used by patients during sleep. However, current telemetry is not only limited in scope, it is also limited to being integrated in new products (retrofitting or backwards compatibility is not possible) and operating on proprietary protocols and methods. Proprietary methods "lock" medical professionals into a problematic situation where only one kind of bedside device can be used and other devices are rendered inoperable. Standard compliance telemetry is insufficient for proper evaluation of treatment effectiveness. In some extreme cases, without physician personal intervention, even with "passing" compliance telemetry, the treatment is proven to be completely ineffective to the detriment of the patient. Furthermore, current systems do not allow patient self-reporting, which is essential for evaluating effectiveness of treatment.

SUMMARY

[0004] According to one embodiment of the present invention, a remote patient feedback system is configured to electronically transmit real-time patient data about a patient undergoing treatment. The system is further configured to receive objective physiological patient data and subjective patient self-reporting data and to combine the objective data and the subjective data for transmission to a health care professional. The system includes a sensor and a computer system. The sensor is configured to detect an objective physiological parameter of a patient in real-time. The computer system is configured to process and store object patient data and subjective patient data, the objective patient data comprising the objective physiological parameter detected by the sensor. The computer system includes a display device, an electronic interface, a memory device, and a network device. The display device is configured to display a graphical user interface comprising an interactive option configured to permit input of subjective patient self-reporting data based upon at least one of how the patient is responding to treatment and how the patient is feeling at any one point in time. The subjective patient self-reporting data enhances the value of the objective physiological data when both are transmitted to the patient's health care professional. The electronic interface is configured to connect to the sensor and to receive objective patient data from the sensor. The memory device is configured to store objective and subjective patient data. The network device is configured to connect to a remote computer system and to digitally transmit the objective and subjective patient data to the patient's health care professional.

[0005] In addition, the system may include a medical device that includes the sensor. The medical device may include a continuous positive airway pressure (CPAP) machine. The sensor may include a pressure sensor configured to be connected to a breathing tube used by a patient without disrupting a flow of air to and from the patient.

[0006] According to an additional embodiment of the present invention, a computerized method stores and transmits patient data, including objective patient physiological data and subjective patient self-reporting data. The method includes store a health care professional profile associated with a health care professional. The method includes storing a patient profile associated with a patient and associating the patient profile with the health care professional profile. The method includes receiving from a remote computer system and storing objective physiological data and subjective patient self-reporting data. The objective patient data includes an objective physiological parameter of the patient. The subjective patient data includes an indication of how the patient is responding to treatment, an indication of how the patient is feeling at any one point in time, or both. The subjective data enhances the value of the objective physiological patient data when both are reviewed by the health care professional. The method includes transmitting the patient data to a doctor terminal associated with the health care professional.

[0007] In addition, the doctor terminal may include at least one of a website, a mobile app, a mobile device, a smartphone, a table, and a laptop. The method may further include storing an alter template that includes an alter criterion. The alert template may be associated with the doctor profile. The method may include comparing the patient data to the alert template, generating an alert if an alert criterion is satisfied, and transmitting the alert to the doctor terminal.

BRIEF DESCRIPTION OF THE FIGURES

[0008] The detailed description of some embodiments of the present invention is made below with reference to the accompanying figures, wherein like numerals represent corresponding parts of the figures.

[0009] FIG. **1** shows a schematic view of medical device telemetry collection, according to one embodiment of the present invention.

[0010] FIGS. **2**A and **2**B show a flowchart of one embodiment of the present invention.

[0011] FIG. **3** shows a schematic view of an exemplary patient terminal, according to one embodiment of the present invention.

[0012] FIG. **4** shows a schematic view of an exemplary doctor terminal, according to one embodiment of the present invention.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

[0013] By way of example, and referring to FIGS. **1**-**4**, one embodiment of the present invention comprises a system **10** for monitoring patient treatment. The system **10** may include a doctor terminal **12**, a cloud server **14**, a patient terminal **16**, and a medical device **18**, such as, e.g., a continuous positive airway pressure (CPAP) machine **18**A. The system **10** may use telemetry data logging and client-server information

technology to provide data streams from the patient terminal **16** to the cloud server **14** for exploitation. For example, patient terminal **16** may be situated in a patient's home, where it may be connected to, e.g., a CPAP machine **18**A or other medical device **18**. While the patient is sleeping, the data **20** from the CPAP **18**A may be uploaded from the patient terminal **16** to the cloud server **14** over an existing or proprietary network. Referring to FIG. **4**, when the patient wakes up, the patient terminal **16** may ask pre-selected questions of the patient, in a process known as patient self-reporting **22**. The patient terminal **16** may upload the self-reporting data **22** to the cloud server **14**. The cloud server **14** may store and/or index the CPAP data **20**, the self-reporting data **22**, or both in a database or other facility **24**.

[0014] The doctor terminal **12** may accesses the cloud server **14** via an existing or proprietary network. The doctor terminal **12** may include, e.g., a dashboard website **26** or web application running on a personal computer, a mobile app running on a smartphone or tablet **30**, and so on. The doctor terminal **12** may provide efficient, timely access to treatment data. A doctor using the doctor terminal **12** may search patient data, configuring self-reporting questions, and create reports from patient data. A doctor or other provider may use the doctor terminal **12** to enter an alert template **32** into the cloud server **14**, and the cloud server **14** may use data analysis **34** and alert templates **32** to create one or more alerts. An alert may manifest as a notification to doctor, patient, or both, prompting additional physician action or treatment modification. The data logging feature **24** of the cloud sever **14** may provide the ability to create reports or automatically create or export data to medical billing forms **36**.

[0015] The patient terminal **16** may include a standalone device, which may include a display, an input device, memory, a processor, a connector for connecting to the medical device **18**, and a communication module. The communication module may include, for example, a modem, a wireless networking device, a mobile wireless radio, or the like. The patient terminal **16** may include an application that runs on a mobile device platform, such as, e.g., a smartphone, tablet, or the like. The patient terminal **16** may include short-range wired or wireless communication interface **38**, such as, e.g., USB, NFC, Bluetooth, or the like, for communicating with a medical device **18** or medical device sensor **40**. For example, the medical device **18** may include a CPAP **18**A that is configured to communicate with the patient terminal **16** via communication interface **38**. To work with a CPAP **18**A that lacks this capability, the patient terminal may include an airway connector **42** that may join two sections of airway tubing **44**. A pressure tube **46** may be attached to the connector **42**. The connector **42** may include a device sensor **40**, such as, e.g., a pressure sensor. Other types and arrangements of sensors are contemplated for use with different medical devices **18**. The connector **42** may be configured to connect to the communication interface **38**.

[0016] The cloud server **14** may parse incoming messages and store data in a database **24**. The messages may include data that has been formatted according to an XML protocol. For example, an open XML standard or protocol may be used to allow medical devices **18** to communicate with the server **14**. The protocol or message standard may include, e.g., patient information, device information, daily device record, patient self-reporting data, device history, or a combination thereof The patient information may include, e.g., name, address, unique identifier, geolocation, and/or device identity. The device information may include, e.g., an identification string. The daily device record may include, e.g., one or more readings from the medical device **18**. Each reading may include, e.g., date and time of the reading, and the reading itself For example, the reading itself may include a pressure reading for a CPAP **18**A. The patient self-reporting data may include, e.g., one or more doctor's questions and the patient's answer to each question. The device history may include, e.g., some or all device readings from the current time to a past time, and the history may include all readings stored on the medical device **18** or patient terminal **16**.

[0017] Persons of ordinary skill in the art may appreciate that numerous design configurations may be possible to enjoy the functional benefits of the inventive systems. Thus, given the wide variety of configurations and arrangements of embodiments of the present invention the scope of the present invention is reflected by the breadth of the claims below rather than narrowed by the embodiments described above.

What is claimed is:

1. A remote patient feedback system configured to electronically transmit real-time patient data about a patient undergoing treatment, the system configured to receive objective physiological patient data and subjective patient self-reporting data and to combine the objective data and the subjective data for transmission to a health care professional, the system comprising:

a sensor configured to detect an objective physiological parameter of a patient in real-time; and

a computer system configured to process and store objective patient data and subjective patient data, the objective patient data comprising the objective physiological parameter detected by the sensor, the computer system comprising:

a display device configured to display a graphical user interface comprising an interactive option configured to permit input of subjective patient self-reporting data based upon at least one of how the patient is responding to treatment and how the patient is feeling at any one point in time, the subjective patient data enhancing the value of the objective physiological patient data when both are transmitted to the patient's health care professional,

an electronic interface configured to connect to the sensor and to receive object patient data from the sensor,

a memory device configured to store objective and subjective patient data, and

a network device configured to connect to a remote computer system and to digitally transmit the objective and subjective patient data to the patient's health care professional.

2. The system of claim **1**, further comprising:

a medical device comprising the sensor.

3. The system of claim **2**, wherein the medical device comprises a continuous positive airway pressure (CPAP) machine.

4. The system of claim **1**, wherein the sensor comprises a pressure sensor configured to be connected to a breathing tube used by the patient without disrupting a flow of air to and from the patient.

5. A computerized method for storing and transmitting patient data, including objective patient physiological data and subjective patient self-reporting data, the method comprising:

storing a health care professional profile associated with a health care professional;

storing a patient profile associated with a patient and associating the patient profile with the health care professional profile;

receiving from a remote computer system and storing objective patient physiological data and subjective patient self-reporting data, the objective patient data comprising an objective physiological parameter of the patient, the subjective patient data comprising at least one of an indication of how the patient is responding to treatment and an indication of how the patient is feeling at any one point in time, the subjective patient data enhancing the value of the objective physiological patient data when both are reviewed by the health care professional; and

transmitting the patient data to a doctor terminal associated with the health care professional.

6. The method of claim **5**, wherein the doctor terminal comprises at least one of a website, a mobile app, a mobile device, a smartphone, a table, and a laptop.

7. The method of claim **5**, further comprising:

storing an alert template comprising an alert criterion, the alert template associated with the doctor profile;

comparing the patient data with the alert template;

generating an alert if an alert criterion is satisfied; and

transmitting the alert to the doctor terminal.

* * * * *

专利名称(译)	用于远程监测患者治疗的系统和方法		
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[标]申请(专利权)人(译)	CRIBBS WILLIAM乙 RUGAMA ARNOLD		
申请(专利权)人(译)	CRIBBS，威廉B. RUGAMA，ARNOLD		
当前申请(专利权)人(译)	CRIBBS，威廉B. RUGAMA，ARNOLD		
[标]发明人	CRIBBS WILLIAM B RUGAMA ARNOLD		
发明人	CRIBBS, WILLIAM B. RUGAMA, ARNOLD		
IPC分类号	A61B5/00 G06Q50/22 A61B5/08		
CPC分类号	A61B5/0022 G06Q50/22 A61B5/08 A61B5/4836 A61B5/7435 G16H20/40 G16H40/67		
外部链接	Espacenet USPTO		

摘要(译)

公开了用于远程监测患者治疗的系统和方法。医疗设备可以将遥测直接发送到患者终端，或者医疗设备可以改装有用于患者终端收集遥测的仪器。患者终端可以收集患者自我报告数据。可以将遥测和自报告数据发送到云服务器，云服务器可以存储患者数据。患者数据可用于生成警报，或者可将其发送到医生终端以供显示和查看。