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(54) **PATIENT MANAGEMENT DEVICE, SYSTEM AND METHOD**

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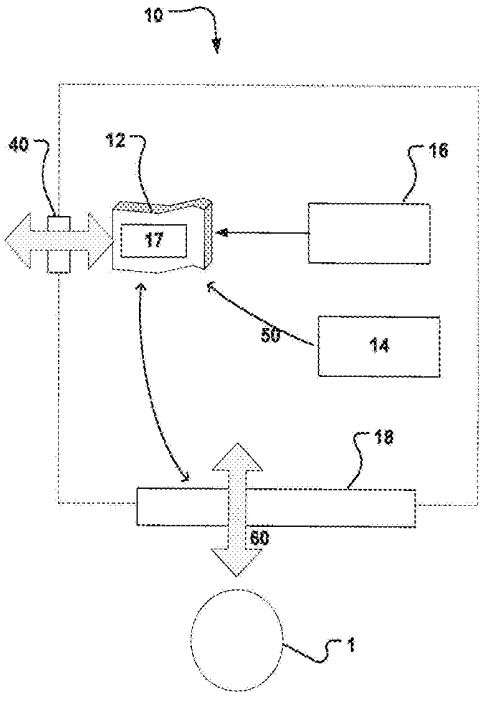
(57) **ABSTRACT**

A method for a user unit, a user unit and a system comprising said user unit. A unit (**10**) comprising a task manager (**11**) arranged to control the user unit; a communication interface (**12**) arranged in connection with task manager (**11**) and arranged for communication with an external device; one user interface (**13**) disposed in communication with the task manager (**11**) and adapted for communication with a user; a real-time interpreter (**14**) arranged in said communication task manager (**11**) and in communication with an instruction memory (**15**) and a data memory (**16**) and adapted to interpret event definitions, query lists, and at least a predefined schedule stored in the user units instruction memory (**15**); a real time clock (**17**) arranged in communication with the task manager (**11**) and arranged to continuously update the time, the task manager (**11**) is arranged to control communication with an external device and/or a user based on interpretations of the interpreter makes the event definitions, query lists, and the at least one predefined schedule, and based on the current time.



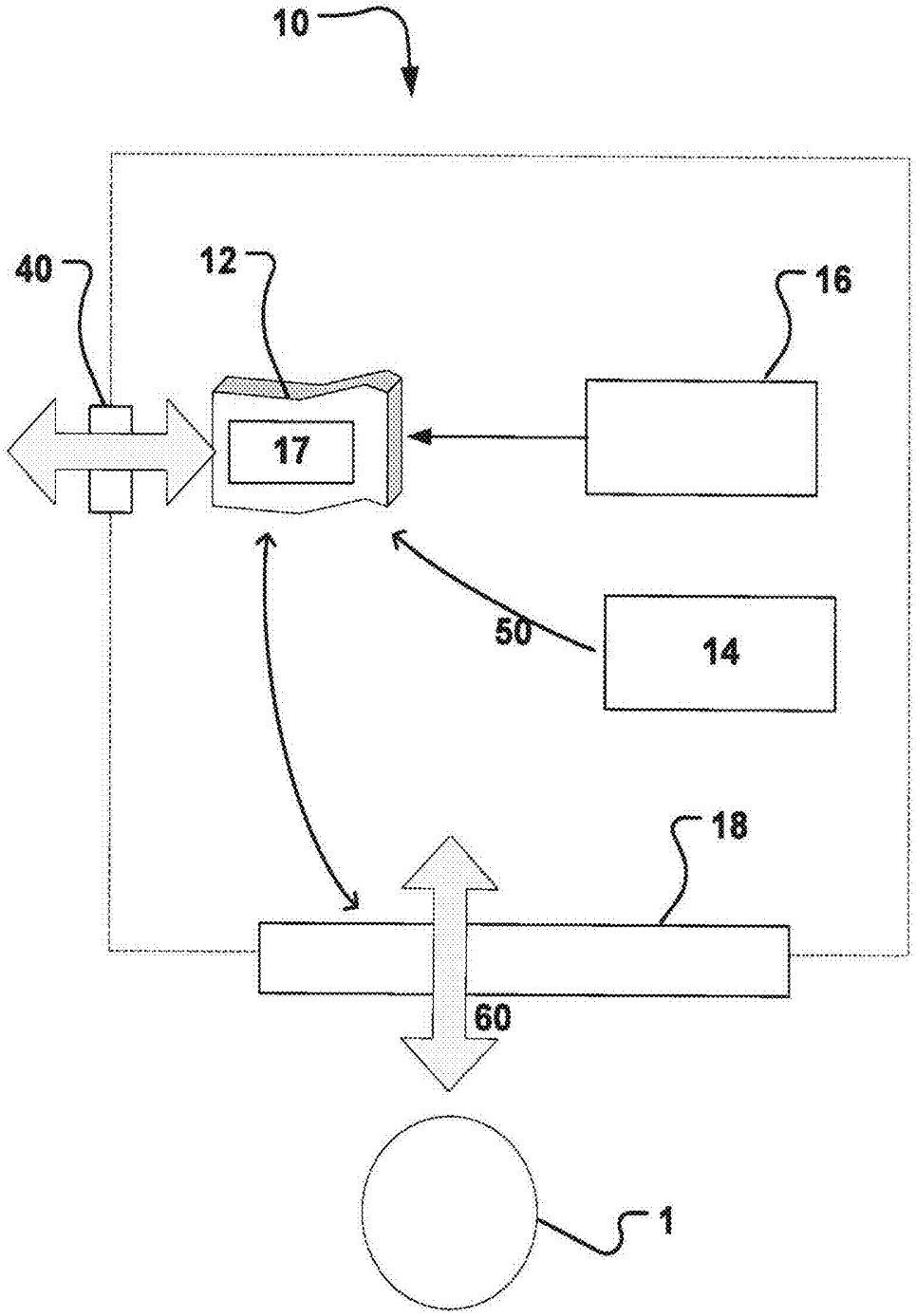


Fig. 1

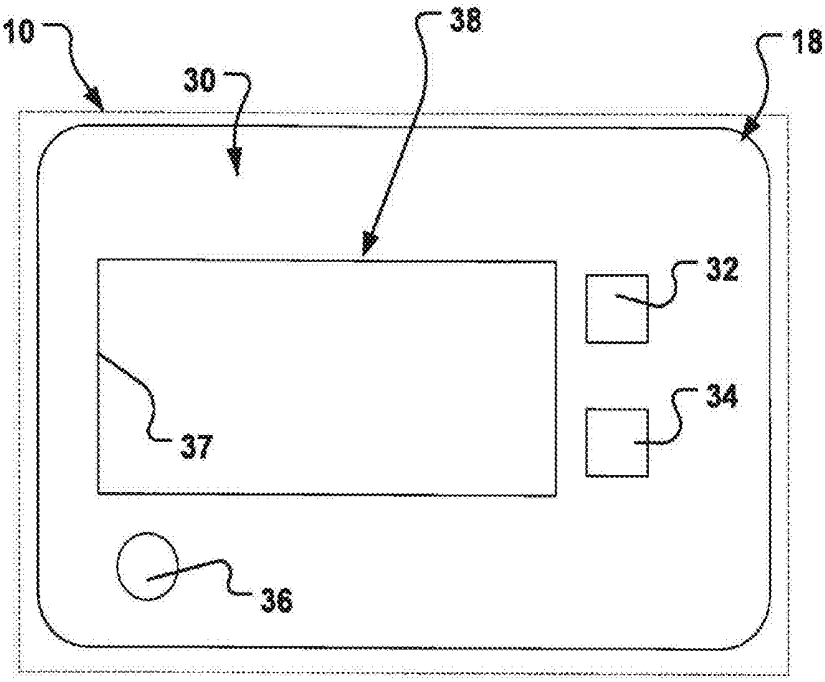


Fig. 2

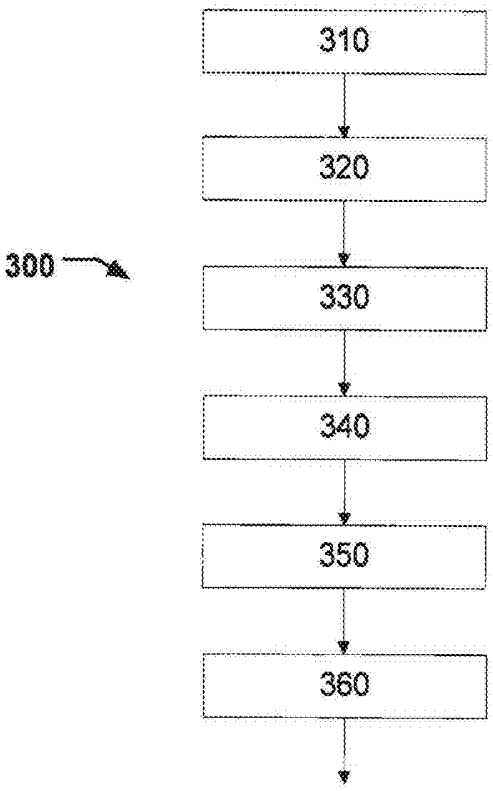


Fig. 3

Fig. 4A

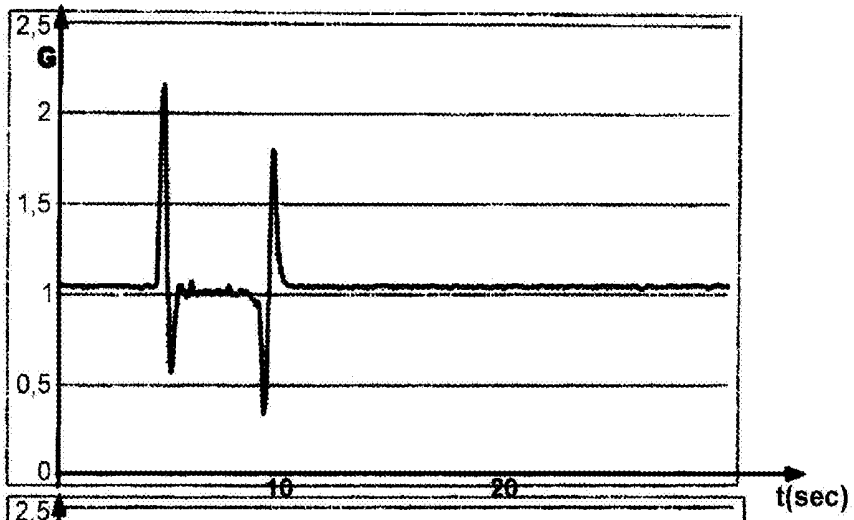


Fig. 4B

Fig. 4C

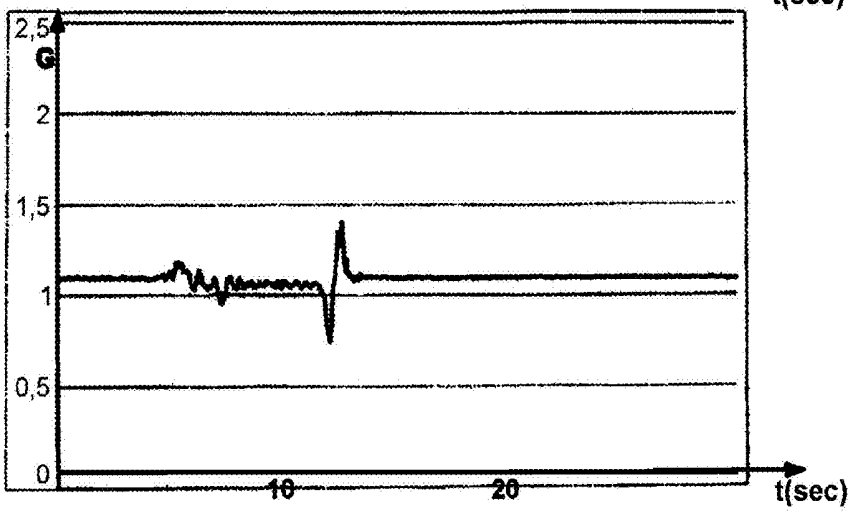


Fig. 5A

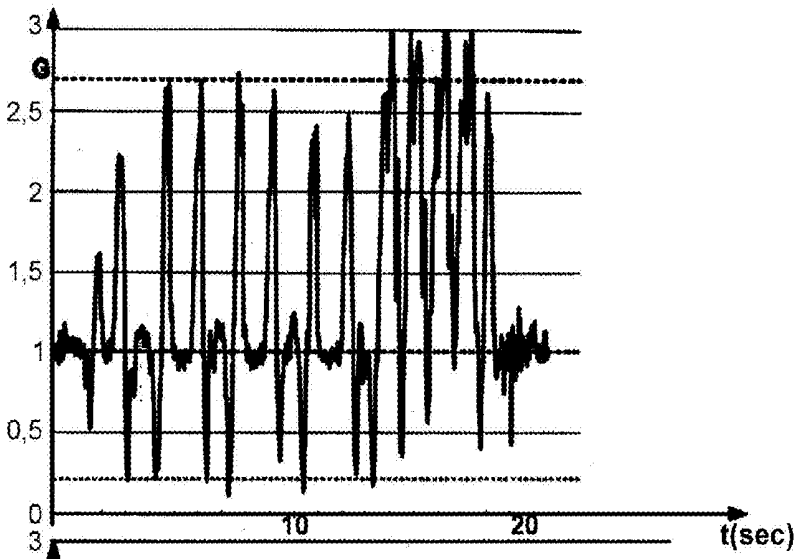


Fig. 5B

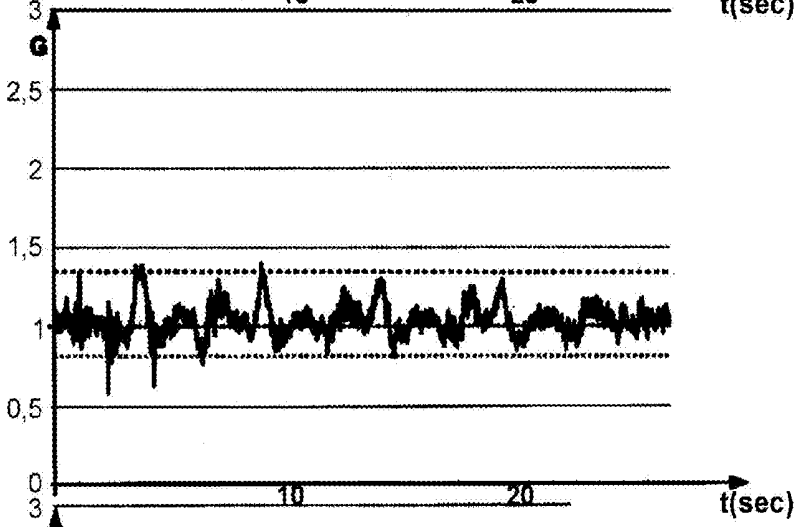


Fig. 5C

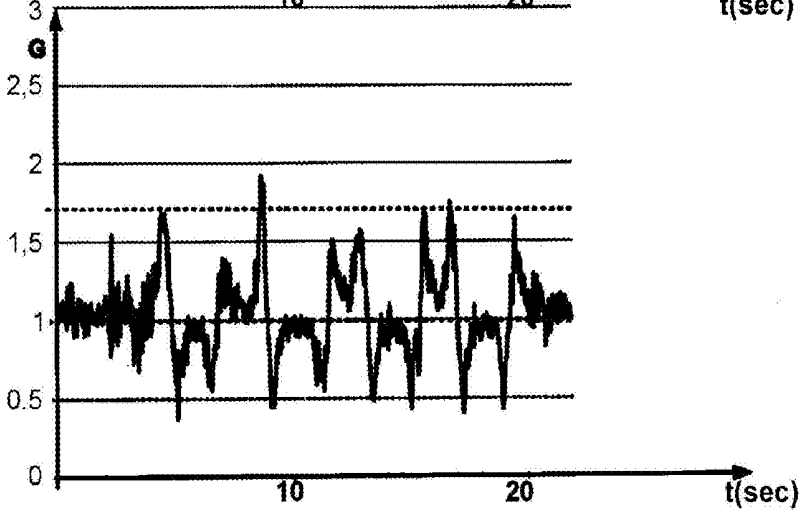


Fig. 6A

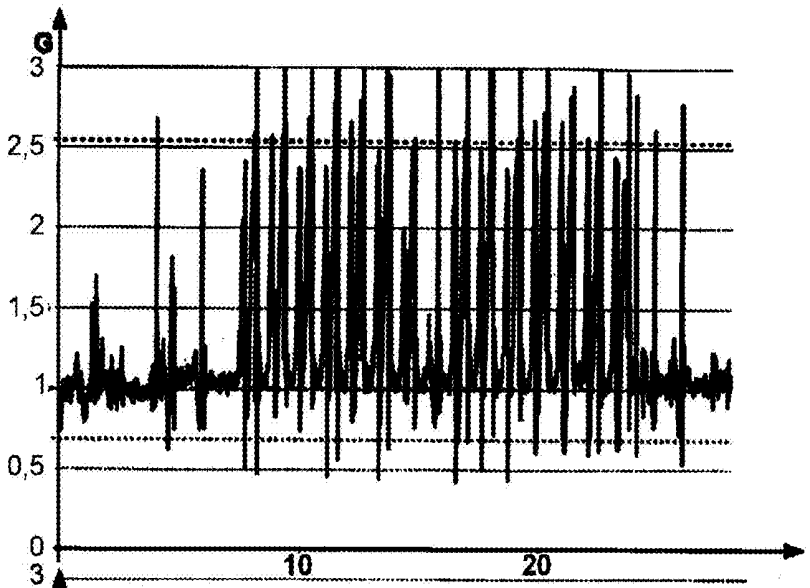


Fig. 6B

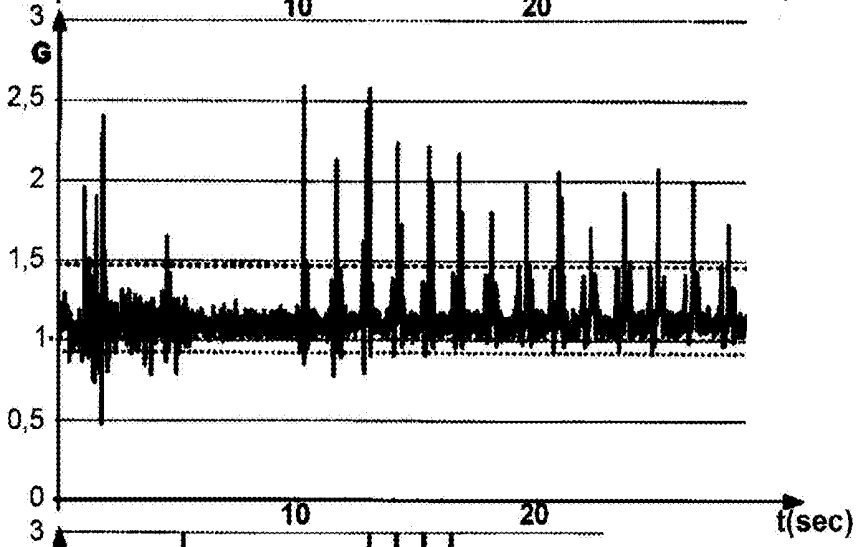
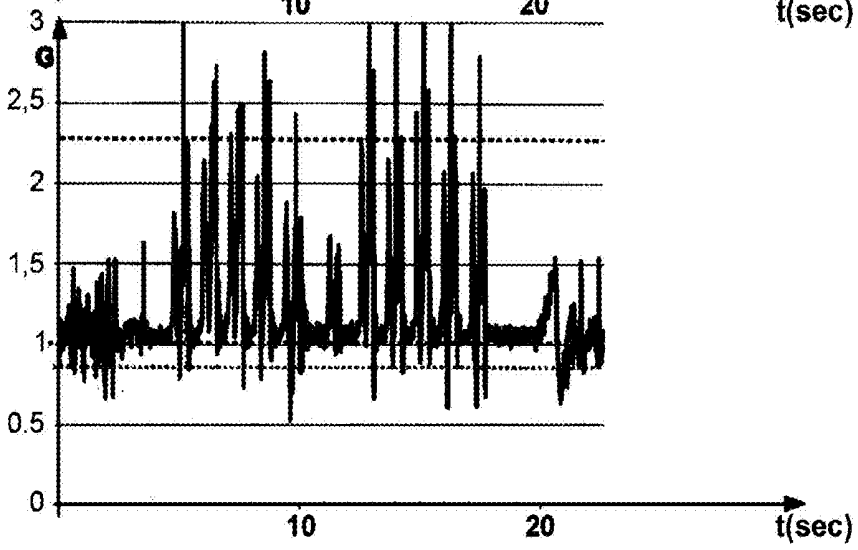


Fig. 6C



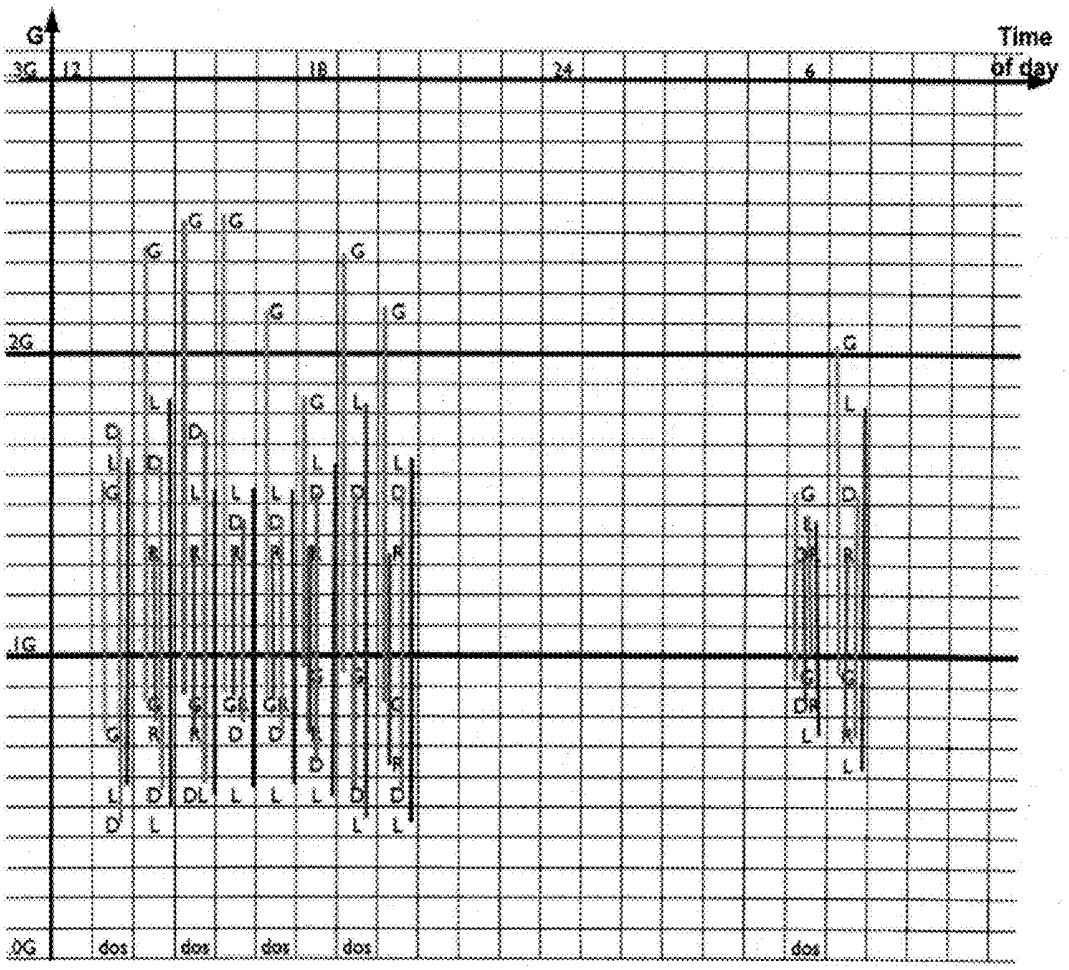


Fig. 7

PATIENT MANAGEMENT DEVICE, SYSTEM AND METHOD

TECHNICAL FIELD

[0001] The present invention relates to a method for a user unit, a user unit and a system comprising said user unit. The user unit is preferably a patient unit for logging the patient-related information between two visits to the doctor, for example.

BACKGROUND OF THE INVENTION

[0002] Today there is a need in e.g. medical care that during a short period of time gather information about a person such as how the person feel, or what a person does at different periods under a time period, and to evaluate the collected information on completion of the period of time. For example, this can concern that under a long time get information on how often and how long a person, for example, has back pain, and how bad the back pain of the patient is.

[0003] It may also be desirable to remind a person or a patient to take their medications as that it is done regularly and to monitor how the patient is doing after the medicine is taken.

[0004] There is thus a need for an interactive system that allows simple and effective collection of personal event information during a longer time period, and analysis of the collected information.

SUMMARY OF THE INVENTION

[0005] The present invention relates to a method for a user unit, a user unit and a system comprising said user unit. The user unit is preferably a patient unit for logging the patient-related information between e.g. two visits to the doctor.

[0006] The present invention is defined in the independent claims. Preferred embodiments are defined by the dependent claims.

[0007] In the description of the present invention, the following definitions will be used.

Definitions

[0008] Base time: The absolute time a cyclical schedule is based on. When all events in a cycle has occurred, a new basic time as the sum of the previous basic time and cycle time. The new base time can be created by the interpreter.

[0009] GUID: Global unique ID. A sufficiently large integer that can provide an application unique identity to various sub-components.

[0010] Standby: Status of the system/user unit when no activity occurs in the system/user unit.

[0011] Alarm: Activity that awakens the system or any part of the system from standby and maybe calls on the user's attention through, such as sound, light or vibration. An alarm can be generated by the real-time clock, manually or by an external unit.

[0012] Message: Text presented to the user. A message must always be acknowledged, i.e. the user must confirm that the message was received.

[0013] Question: The system displayed message where the user acknowledges either with a logical answer (Yes/No) or a numeric response, for example, 1-10. The user can also generate an activity in which the system/user unit presents the desired information.

[0014] Event: Activity initiated by an alarm or other event. The event can be interactive, for example, the user must answer a question, or covert, the system generates an activity that does not need to be acknowledged, for example, reading an external unit. Each event has a unique identity in the system. The event can generate reading of a measured value from an external unit, such as from a temperature sensor, heart rate monitor, blood pressure monitor, etc. The event is either triggered at specific time(s) or user activated.

[0015] Schedule: Rules for how the events should take place in time. The schedule can be either based on absolute time and/or cyclically based on a basic time, periodicity and a number of relative times.

[0016] Reminder: If a question is not answered within a certain, possibly predefined time, an alarm time can be set and the system will go into standby. When the alarm time is activated a reminder is activated.

[0017] Logging: Activity where information about the event is stored such as identity, time and answer/reading.

[0018] Question list: One type of event with a set of questions/messages where the next question/message may depend on the user's response. Each list of questions has a unique identity.

[0019] Event Definition: An event may be defined as follows:

[0020] a) Unique Identity

[0021] b) Message

[0022] c) Event

[0023] d) Rules for initialization

[0024] e) Response Policy

[0025] f) Rules for reminders

[0026] g) Rules for logging

[0027] h) Any resulting events

[0028] i) Any related question lists

[0029] j) Schedule

[0030] Event Table: A set of complete event definitions, for example, created by an administrative system. The event table is sorted in order of priority.

[0031] Survey: A set of event definitions and question lists, which can be saved and reused for multiple user units.

[0032] Planning Table: A table created by the user unit interpreter at the initiation of the user unit. Each event in the event table has its own entry in the same. It includes e.g. the time for the next instance of the event, latest event time, number of made reminders, basic time for the event schedule and the last response.

SHORT DESCRIPTION OF DRAWINGS

[0033] The present invention will now be described in more detail with reference to the accompanying drawings, in which:

[0034] FIG. **1** schematically shows an embodiment of a system according to the invention;

[0035] FIG. **2** schematically shows an embodiment of a user unit according to the invention; and

[0036] FIG. **3** schematically shows an embodiment of a flowchart of an inventive method.

DETAILED DESCRIPTION OF THE INVENTION

[0037] The present invention will be described in more detail with reference to figures FIGS. **1** and **2** schematically show embodiments of a system **100** and a user unit **10** according to the invention.

[0038] FIG. **1** shows a system **100** comprising a subscriber unit **10**, such as a patient unit, disposed in communication with an administrative system **20**. The administrative system **20** may be a first external computerized unit **20** such as a computer, such as a desktop or portable personal computer, via a communication network **30**.

[0039] The user unit is preferably a stand-alone unit adapted to communicate with a user. Each user unit can have a unique external identity and can be identified by for example by an ID number or a bar code. The user unit preferably has an inner identity, called a GUID, by which the user unit is identifiable by others in components of the system. The user unit contains a microprocessor with associated program memory for drivers, task manager and an interpreter. The user unit further includes a real time clock, components for displaying and entering information, to communicate with administrative systems and peripherals, and memory for storing program and output of the interpreter.

[0040] The first external computer **20** is further disposed in communication with a database **40**. The external computer **20** may be arranged to communicate with the database **40** directly or via a wireless or wired communication networks, for example via the communication network **30**. Further, said first computer **20** may be adapted to administer one or more user units **10** and for creating one or more reports **60**.

[0041] The administrative system **20** may include a compiler (not shown) adapted to prepare case definitions and question lists for the user unit interpreter. That is, the compiler may be arranged to define and create the event definitions and question lists to be transferred to a given user unit. The compiler may be implemented by software.

[0042] As shown in FIG. **1**, a second external computerized unit **50**, e.g. a computer such as a desktop or notebook PC, may be provided in communication with the database **40**. Said second computer **50** may be provided for organizing of events and question lists.

[0043] FIG. **2** shows an embodiment of a user unit **10** comprising a task manager **11** that is disposed in communication with a communications interface **12** for communication with an administrative system **20** and any additional external unit. The task manager is further adapted to control how the system resources are used, and can be realized as an overarching process.

[0044] The user unit **10** further includes a user interface **13** provided in communication Task **11** and adapted for communication with a user. User interface **13** may include input means, such as a keyboard, microphone, touch sensitive display, and output means, such as screen and speakers. The user interface can be realized as a method and/or a unit for communication between devices in the system.

[0045] The user interface can also be used to present or gather information.

[0046] User unit **10** further includes a real time interpreter **14** having an instruction memory **15**, also referred to as a program memory **15**, and a data memory **16**. The interpreter is adapted to interpret case definitions and question lists saved in user unit even program memory **15** and, based on the interpreted event definitions and question lists communicate with the task manager which can control the communication with the user based on the interpreted result.

[0047] In the data memory **16** are stored the results of performed activities/events, e.g. information related to the user's answers to questions. Preferably, the interpreter is realized by software in the user unit. In embodiments of the invention, the interpreter makes a central component of the user unit's software.

[0048] The instruction memory **15** and data memory **16** can be integrated in said real time interpreter **14**, but they can also be separate parts arranged in communication with said real time interpreter **14** and the task manager **11**.

[0049] A real time clock **17** is also contained in the user unit **10** and disposed in communication with the task manager **11**. The real time clock is further arranged to continuously update a numerical representation of the time.

[0050] It is understood that the arrows in FIGS. **1** and **2** illustrate the direction of a communication and/or information of flow. Thus the bi-directional arrows illustrate bidirectional communication and/or bidirectional information flow.

[0051] Task manager **11** is arranged to control the communication between the components of user unit **10**.

[0052] The interfaces **12**, **13** can be handled via the drivers for the hardware. The interfaces **12**, **13** may be adapted to initiate activities, which activities should be addressed by the task manager **11** depending on the current system status.

[0053] The interpreters **14** program memory **15** and data memory **16** is handled via task manager **11** such that the interpreter **14** is independent of any hardware.

[0054] The transfer of information between the administrative system **20** and the user unit **10** may be via a physical link, either by wire, such as the USS (Universal Serial Bus), or wireless, for example, via Bluetooth, infrared communication, SMS (Eng. Short Message Service) or similar. The transfer is performed via a protocol which partly allows a bidirectional transfer of event tables, question lists and other system data. The administrative system can also give the user unit **10** commands of the type initiate interpreter **14**, set the time **17**, etc.

[0055] The user unit can be arranged to be activated when connected to the administrative system. At the initiation of the communication between the user unit and the administrative system the administrative system controls the user units identity, GUID, to ensure that the user unit has access to the administrative system. In embodiments of the invention all other types of activity are stopped when the user unit connects to the administrative system, but it should be understood that certain activities can continue even on connection.

[0056] Transfer of data between the user unit **10** and a so-called external unit, i.e. a device located outside the user unit **10**, can be done by the external unit enabling the user unit from a standby mode to an active mode.

[0057] In embodiments of the invention, the communication with the user is performed by means of the user interface by displaying a text and/or an image on a monitor, whereby the acknowledgment or reply should be given by the user via the input components. The user interface **13** is also used to enable the user unit from its standby mode.

[0058] In embodiments of the invention, the real-time clock **17** is performed by software periodically activated in

the processor, but can also be realized of an independent circuit which can activate the user unit **10** at a preset or predetermined time.

[0059] In embodiments of the invention the interpreter **14** is realized by software which is capable of planning and performing instructions specified in the interpreter's program memory **15**. The instructions are defined by the event table, question lists and/or the planning table.

[0060] Preferably, the interpreter **14** is configured to manage one or more of the following activities:

[0061] Initiation

[0062] Scheduled events

[0063] Events generated by external devices

[0064] Self-Reported events

[0065] Consequence Events

[0066] Query Lists

[0067] Questions asked by the user

[0068] How these activities should be handled is defined by the event table and/or the planning table.

[0069] The activity "Initialization" is controlled from the administrative system via the task manager. At the initialization the planning table with the timing of the next event, the schema's basic time etc. is created. Planning tables are stored in the user units program memory.

[0070] The activity "scheduled event" is initiated/activated by the real time clock in the user unit. If there are higher prioritized events an alarm is set in the real time clock to the next higher prioritized event. When the event is taken care of calls of any consequential events and question lists are performed. Then a check of when the next event will occur is performed. If a higher priority event is scheduled during the period, and the current event is interruptible the higher prioritized event is performed. Thereafter, further processing of the lower priority event is performed if allowed by the treatment rules.

[0071] The activity 'Event generated by external devices" has in embodiments of the invention, the highest priority and interrupts all possible ongoing events. Normally this requires no user interaction. For example, an external device, e.g. a temperature sensor or a pedometer, register a value that exceeds a certain maximum or falls below a specified minimum value.

[0072] The activity "Self-reported event" is generated through the user interface. A "Self-reported event" is an event that the user enters in the user unit without preceded by a call or reminder from the user unit. For example, a user input all the times he/she has a headache, have fallen or have felt unwell for any reason.

[0073] The activity "Consequence Event" is not scheduable, i.e. it does not follow any schedule. In embodiments of the invention "Consequence Event" is activated by any of activities "Initiation", "Scheduled event", "Event generated by external device" and/or "Self-reported event" as described above. A "consequence event" may affect the timing of the next event in a scheduled event. Examples of "consequence events" can be a follow-up question such as "Did you take your aspirin?" when a user has indicated that he/she has a headache.

[0074] The activity "Question list" is initiated by any of the above-described event types. It can be non-interruptible or uninterruptible followed by further processing.

[0075] A list of questions can be "simple", i.e. consist of a number of questions that are answered in turn.

[0076] An example of a simple list of questions are:

[0077] Is it raining outside? (Yes/No)

[0078] What is the temperature? (−50° C.-+50° C.)

[0079] etc.

[0080] A list of questions can also be branched, i.e. consist of supplementary questions and which is dependent on the answer to the previous question. An example of a branched list of questions are:

[0081] Is it raining outside? (Yes/No)

If the answer is yes, the question is asked:

[0082] Does it rain a lot? (Yes/No)

If the answer is No, the question is asked:

[0083] Is the sun shining? (Yes/No)

etc.

[0084] The activity "Questions asked by the user" is activated by the user. The user can ask questions like, "When did an event occur the last time", "When will the event take place next" or "How many times has a certain event occurred".

[0085] Embodiments of the present invention also relates to a method comprising one or more steps **1010-1060** below, cf. FIG. **3**.

1010 Organization of Events and Question Lists

[0086] In step **1010**, the programming is done by the user unit **10** and one or more of the components a)-g) in event definition is created, i.e. the unique identity; message; event; rules for initialization; response rules; rules for reminders and/or logging rules, created.

[0087] One rule for initiation, can for example define if an event should be active on startup and in that case also define when the next instance of the event will happen.

[0088] The reply rules may for example include the following:

[0089] is the event interactive, i.e., should a question be answered by a user;

[0090] what kind of response is logically expected (Yes/No) or a numeric value;

[0091] how the answer options is to be presented to a user;

[0092] what range is there to the answer, for example, a minimum value and a maximum value;

[0093] which start value should be used;

[0094] the reply value to be used if no reply;

[0095] Rules for reminders may include for example the number of times a user to be reminded of a missed event, and how long the interval should be between reminders.

[0096] Logging rules could comprise rules on how and if information about an event should be logged/saved, and if an event is logged even if a user misses it.

[0097] In embodiments of the invention may also result events (h) and question lists (i) coupled to the event definition. Further, step **1010** can also include programming and compiling question lists.

1020 Choice of Events

[0098] In step **1020** the administrator selects events, consequence events and/or question lists that are relevant to the user unit. Further, the administrator can create any schedule of events. The selected event definitions can be saved as an investigation. A saved examination can be used as a template at a later election administrator. Further can complete event

definitions be created and compiled into an event table. This step is performed in embodiments of the invention in the administrative system **20**.

1030 Transfer to the User Unit

[0099] Step **1030** includes that the user unit connects to the administrative system, illustrated in FIG. **2** of the external computer **20**. Step **1030** further includes event table and any question lists are transferred to the program memory of or in communication with the user units interpreter. Further, step **1030** comprises the user unit being disconnected from the administrative system and given to the user. The protocol for communication between the administrative system and the user unit may include support for the following activities:

[0100] identification of the user;

[0101] transmitting information to and from the user unit;

[0102] adjustment of real time clock;

[0103] initialization of the interpreter.

1040 User Activities

[0104] In step **1040**, the user unit separate from the administrative system and the unit communicates, via the user interface, the user according to the scheduled events.

[0105] The user is also able to report events or to ask questions. If the event definition specify that the information about the event should be saved, it will prompt the interpreter to save this data in its data memory.

1050 Transfer from the User Unit.

[0106] In step **1050**, connects the user unit to the administrative system by e.g. the user submits the user unit to the administrator to connect the unit to the administrative system. Step **1050** further includes information stored in the data memory of the interpreter transferred to the administrative system. Initiation of the interpreter via the communication protocol, see step **1030**. If the survey and logging of data will continue with the same event definition called an UE re-initialized) and returned to the user for further use. If the investigation is complete and no more data to be logged user unit retained by the administrator so that it can be reused for a new investigation.

1060 Analysis

[0107] Step **1060** includes analyzing information transmitted from the user unit to the administrative system. Analysis results can be presented to an administrator in the form of reports.

[0108] In embodiments of the present invention, the user unit is a patient unit for logging of patient-related information between two doctor visits, for example, but it should be understood that the finding other applications of the invention.

[0109] The information presented to the patient can be activities in the form of questions and reminders that are scheduled by the patient's physician. These scheduled tasks are preferably predefined by the doctor. The questions can be questions to determine the patient health conditions at different times of the patient's response and the timing of the response is saved inpatient unit. Depending on the patient's response various actions can be taken. The choice of the resulting action may also depend on the patient's medical history. Following action can be a follow-up question, such as "Does the medicine work?" if the patient has answered yes to the question "Have you taken your medicine?", but can also be a proposal on an activity, such as taking a certain type of medicine or performing a physical activity.

[0110] Information that the patient inputs may be the answer to questions from the patient unit but that may also be information relating to events in the patient's life. For example, if a patient has fallen, have headaches or dizziness and this information can be input along with the timing in the patient unit. Once the patient comes back to her doctor, all Information in the patient unit is downloaded to an external computer for collection and analysis, the doctor can use the compilation and analysis as a decision basis for further patient treatment.

[0111] The invention is of course not limited to the above exemplary embodiments but may undergo modifications within the scope of the inventive concept in subsequent claims. Particularly noted that each illustrated hardware or software, unit and/or component can be combined with other illustrated unit and/or component to obtain the desired technical function.

What is claimed is:

1. A portable apparatus for managing a plurality of events related to a patient and for recording and storing input data related to said events, said portable apparatus comprising:

a user interface comprising an input unit for registering patient input data elements and an output unit for providing information elements to said patient;

a timer unit arranged to trigger at least a first event of said plurality of events and to tag said input data with a time stamp;

a control unit, arranged to provide an invitation as an instruction via said output unit to said patient to perform a desired movement in a motion exercise, upon said trigger from said timer unit or upon a patient self-initiation;

at least one sensor unit arranged to record measurement data elements related to said motion exercise of said patient, wherein said at least one sensor unit comprises at least one accelerometer adapted to measure a motion of said portable apparatus; and a storage unit, arranged to retrievably store said input data comprising said patient input data elements and said measurement data elements, when recorded by means of said input unit and/or said sensor unit, together with said time stamp, and wherein said storage unit is adapted to store said measurement data elements from said motion exercise performed upon said instruction or upon said patient self-initiation of said motion exercise

wherein:

said input unit is responsive to said invitation provided to said patient by said output unit and upon triggering said event, or to a patient self-initiation;

said portable apparatus is adapted to be held by said patient, or attached in a fixed relation to a body portion of said patient, and thus to serve as a mass to be moved in a desired manner by said patient during said motion exercise in such a manner that said measurement data elements are provided that are related to a movement of said portable apparatus in at least two dimensions by said patient during said motion exercise; and

said control unit is a unit for analyzing said measurement data elements, wherein said analyzing unit is adapted to calculate a speed, direction of movement, distance,

time and force that acts upon the device from said measurement data elements and said time stamp stored together, as provided by said movement and said mass of said portable apparatus, and whereby said control unit is adapted to provide a determination that said movement of said motion exercise has been correctly performed.

2. The apparatus according to claim **1**, wherein said motion exercise is adapted to provide a degree of muscle tone or muscle relaxation of said patient based on said measurement data, and wherein said accelerometer is adapted to provide said measurement data for determination of said degree of muscle tone or muscle relaxation.

3. The apparatus according to claim **1**, wherein said accelerometer is adapted to provide a kinematic determination of a three dimensional motion pattern during said motion exercise.

4. The apparatus according to claim **1**, wherein said motion exercise is selected from a variety of motion exercises comprising:

a) coordinated motions in space, such as throwing the portable apparatus upwards without releasing grip and then lowering it softly back to the starting point of the exercise, or throwing the portable apparatus upwards while releasing grip and then catching the portable apparatus;

b) movement of at least one hand of the patient, such as winding a thread around the portable apparatus, moving the portable apparatus back and forth horizontally on a sturdy surface, or imitate whipping motion;

c) movements of an extremity, such as repetitively lifting an arm or leg, such as lifting an arm quickly upward for instance up to approximately eye level, staying in that position for a predetermined time, and then lowering the arm; moving an arm in a circular motion;

d) walking, such as having the portable apparatus inserted into a sock;

e) repetitively raising and seating down; and/or

f) simulating of free fall.

5. The apparatus according to claim **1**, wherein said user interface has a tactile communication input and output interface, and an acoustic and/or visual output communication interface, and wherein said user interface is adapted to provide an indication to said patient during said exercise for a control of a progress of said exercise, or to indicate borders between different stages of said exercise, including sounds, spoken words, and/or beeps.

6. The apparatus according to claim **5**, wherein said tactile communication interface is adapted to provide a haptic feedback or a vibrational feedback to said patient for said control of progress.

7. The apparatus according to claim **1**, wherein said patient input data and said measurement data are related, and wherein said storage unit is adapted to, in an absence of input data, to register and store a no input data element together with said time stamp.

8. The apparatus according to claim **1**, wherein said events are triggered at predefined scheduled times or at arbitrary times.

9. The apparatus according to claim **8** wherein said predefined schedule settings comprises information and ordination requirements defined by a healthcare provider.

10. The apparatus according to claim **1**, wherein said apparatus comprises a communication unit, and wherein said sensor unit is adapted to communicate with an external sensor device via said communication unit, wherein said external sensor is for instance a further accelerometer, a blood pressure monitor, or a watch type physiological sensor.

11. The apparatus according to claim **10** wherein said communication unit is adapted to transmit information and ordination requirements defined by a healthcare provider.

12. The apparatus according to claim **1**, said storage unit comprising a memory unit for storing an information data base for predefined scheduled settings; and wherein said information data base comprises a plurality of questions.

13. A system comprising in combination at least one apparatus according to claim **1** and an external processing unit, wherein said storage unit is arranged to provide said stored input data for processing to said external processing unit, wherein said external processing unit and/or said control unit is adapted to derive diagnostic data from said stored measurement data elements; and wherein said external processing unit and/or said control unit is adapted to provide a long-term summarized report of said stored input data for a physician.

14. The system of claim **13**, wherein said external processing unit is a local work station adapted to be managed by a healthcare provider; wherein said local work station is arranged to provide at least one portable apparatus with information and ordination requirements; and wherein said local work station is arranged to analyze transmitted information from said at least one portable apparatus.

15. The system of claim **13**, wherein said patient is a patient suffering from a neurological disease, Parkinson's disease, and/or pain.

16. The system of claim **15**, wherein said sensor unit comprises an accelerometer, and said diagnostic data is related to Parkinson's disease and based on a degree of muscle tone derived from said measurement data.

17. The system of claim **13** and further comprising:

a unit for registering movement of said portable apparatus by registration of an output signal from an accelerometer of said portable apparatus during a pre-defined motion exercise, and storing said output signal as measurement data elements, and

a unit for analyzing said measurement data for determining a degree of a neurological disease or an effect of a medication on said neurological disease.

18. The system of claim **17**, wherein said unit for analyzing said measurement data is adapted to analyze pause times in said movements, and wherein said diagnosis is based on said pause times.

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摘要(译)

一种用于用户单元，用户单元和包括所述用户单元的系统的方法。包括任务管理器（ 11 ）的单元（ 10 ），用于控制用户单元;与任务管理器（ 11 ）连接的通信接口（ 12 ），用于与外部设备通信;一个用户界面（ 13 ）设置为与任务管理器（ 11 ）通信并适于与用户通信;安排在所述通信任务管理器（ 11 ）中并与指令存储器（ 15 ）通信的实时解释器（ 14 ）和数据存储器（ 16 ），适用于解释事件定义，查询列表和至少存储在用户单元指令存储器中的预定义时间表（ 15 ）;一个实时时钟（ 17 ），安排与任务管理器通信（ 11 ），并安排不断更新时间，任务管理员（ 11 ）被安排来控制与外部设备和/或用户的通信，其基于解释器的解释产生事件定义，查询列表和至少一个预定义的时间表，并且基于当前时间。