

(19)



(11)

**EP 2 166 929 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:  
**19.12.2012 Bulletin 2012/51**

(51) Int Cl.:  
**A61B 5/145** <sup>(2006.01)</sup> **G01N 27/327** <sup>(2006.01)</sup>  
**G06F 19/00** <sup>(2011.01)</sup> **A61B 5/00** <sup>(2006.01)</sup>

(21) Application number: **08748352.5**

(86) International application number:  
**PCT/CH2008/000222**

(22) Date of filing: **15.05.2008**

(87) International publication number:  
**WO 2008/151452 (18.12.2008 Gazette 2008/51)**

(54) **VISUALIZATION OF A PARAMETER WHICH IS MEASURED ON THE HUMAN BODY**

VISUALISIERUNG EINES IM MENSCHLICHEN KÖRPER GEMESSENEN PARAMETERS

VISUALISATION D'UN PARAMÈTRE MESURÉ SUR LE CORPS HUMAIN

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR**

(72) Inventor: **KRIEFTEWIRTH, Michael**  
**CH-3423 Ersigen (CH)**

(30) Priority: **15.06.2007 CH 966072007**

(74) Representative: **Rüfenacht, Philipp Michael et al**  
**Keller & Partner**  
**Patentanwälte AG**  
**Schmiedenplatz 5**  
**Postfach**  
**3000 Bern 7 (CH)**

(43) Date of publication of application:  
**31.03.2010 Bulletin 2010/13**

(73) Proprietors:  
• **F. Hoffmann-La Roche AG**  
**4070 Basel (CH)**  
Designated Contracting States:  
**AT BE BG CH CY CZ DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR**  
• **Roche Diagnostics GmbH**  
**68305 Mannheim (DE)**  
Designated Contracting States:  
**DE**

(56) References cited:  
**US-A- 5 822 715** **US-A1- 2004 153 257**  
**US-A1- 2007 128 682**

**EP 2 166 929 B1**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

## Description

### Technical Field

**[0001]** The invention relates to a method for visualization of a parameter which is measured continuously on or in a human body, in particular a glucose concentration. The invention also relates to an apparatus and to a computer program product for carrying out the method.

### Prior Art

**[0002]** The body of a person who is suffering from diabetes is unable to produce an adequate amount of insulin, or the body does not react reasonably to the insulin produced by him. This fact leads to an imbalance in the glucose concentration in the blood (and thus to hyperglycaemia or hypoglycaemia), which can result in serious consequences, such as ketoacidosis, complications of the blood vessels, cramps or loss of consciousness. In order to maintain a healthy blood glucose level, diabetic patients normally follow strict dietary programmes and link these with the giving of basal insulin and selective insulin boluses. The giving of insulin must in this case be individually matched to the patient's body in order to supply it with the correct amount of insulin at the correct time. In order to determine the time and amount of the next insulin bolus, patients regularly measure the glucose concentration of their blood and determine the carbohydrate content of their meals.

**[0003]** Instead of carrying out the glucose measurements using strip-based measurement devices, as is done at three to six times by day, and in exceptional cases ten or more times per day, depending on the intensity of the therapy being carried out, it is possible to use continuously operating blood glucose measurement devices. One of the advantages of a continuously operating measurement system is the capability to calculate trend information, which can be done in a worthwhile manner only if the measurement data rate is high. The calculated trend information in this case generally relates to the previously measured values and therefore provides information about the profile of the glucose concentration in the near future. External influences such as the administering of an insulin bolus, consumption of meals or sporting activities influence the accuracy of the trend information. The accuracy of the trend calculation can be increased considerably by feeding information about these external influences to a measurement system thus, in particular, also making it possible to match the dosage of an insulin bolus more accurately to a patient's needs.

**[0004]** The calculated trend information relating to the measured parameter, such as a blood glucose concentration, has until now been indicated, for example, by arrows which represent the trend in the sense of it rising, falling or being constant. An upgraded display of the trend, which provides a finer graduation of the rising or falling states in the form of quickly rising, slowly rising,

etc. and quickly falling, slowly falling, etc. is likewise known in the form of arrow alignments which can be distinguished from one another.

**[0005]** In addition to the abovementioned display of calculated trend information, it is also known for level information relating to the measured parameter to be displayed, with the measured value range of the glucose measurement device being subdivided into three or more levels. In this case, each level generally represents a physiologically relevant range, such as the hypoglycaemic or hyperglycaemic range, or a target value range.

**[0006]** US 2004/153257 A1 (Munk Jens) for example disclose a graphical display which may be used with a plurality of medical devices, such as continuous blood glucose monitors (CBGMs). The display may show a past value of a monitored parameter, a current value as well as a projected value. Further, the display may also show trend data about whether the monitored value moves towards or away of an acceptable value as well as the rate at which the level of the measured parameter is changing.

**[0007]** US 2007/128682 A1 (Rosman et al.) describe a method and a system for identifying and anticipating time-dependent changes in glucose levels. A continuous monitoring system records blood glucose levels over an extended time period. The recorded blood glucose levels are analyzed in the context of significant life events recorded by the patient in a diary system during the monitoring time-period. The analysis is used for recognizing time-dependent glycaemic patterns and to develop a corresponding course of treatment and a reporting element for identifying significant periodic and non-periodic vulnerability to dysglycaemic excursions. Recognition of high risk behaviour by the patient may lead to the generation of alerts and alarms.

**[0008]** The disadvantages of these known forms of display are, inter alia, that arrow information on the one hand gives only an inaccurate and incomplete picture, while more accurate measured value details are in general less useful for the patient, because of lack of specialist knowledge. Furthermore, an indication of level information likewise represents an incomplete picture because these generally represent an instantaneous record and do not provide a historical record of the measured profile of the values. In brief, the previously known forms of display provide the available information inaccurately, incompletely or else in a highly abstract form, and therefore in a form which it is very difficult for the average patient to understand. This is particularly true because the correct interpretation of the corresponding measured variables, which are associated with units such as mg/dl/min, mg/dl/h and the like, in their own right require further understanding of the processes taking place in the body.

### Description of the Invention

**[0009]** The object of the invention is to provide a method associated with the technical field mentioned initially, as well as an apparatus, which make it possible for a

patient to correctly assess his current physiological situation, with respect to its expected development.

**[0010]** The object is achieved as defined by the features of Claim 1. According to the invention, a measured value range for the measured parameter, in particular the glucose concentration, is subdivided into two or more subranges, trend information relating to the future expected profile of the measured parameter is calculated on the basis of two or more measured values. In this case, the calculation can optionally be made more precise by entering additional information relating to the events which influence the measured parameter.

**[0011]** Additional information relating to the events which influence the measured parameter may, for example in the situation in which the measured parameter is a glucose concentration in a person's blood, be the nature, time or for example the carbohydrate content of a meal that has been consumed, an insulin bolus that has been given or the nature and duration of a sporting activity that is being carried out.

**[0012]** A result value, such as a subrange reached or a time period, is determined on the basis of the calculated trend information, the current value of the measured parameter and a definable input value, such as a time period of a subrange to be reached or to be left, for example.

**[0013]** In a first preferred embodiment, a time period is determined after which it is predicted that the measured parameter will have left its current subrange or will have reached a defined subrange, with the time period being based on the current value of the measured parameter and the calculated trend information. The time period determined in this way is then displayed.

**[0014]** In a second embodiment, not forming part of the invention, a subrange is determined, within which it is predicted that the measured parameter will be after a defined time period, with the subrange being determined on the basis of a current value of the measured parameter and the calculated trend information.

**[0015]** For average patients, details of measurement variables generally contain little useful information, because this information is worthwhile only in a specific medical overall context of the measured parameter, together with other, for example physiological, values. In contrast, for example, one variable with which the average patient is familiar is represented by a time period. Indication of a time period, after which it is predicted that the measured parameter, for example the glucose concentration, will have left the current subrange of a plan which the patient can understand and will have entered the next subrange, allows the patient to assess his own physiological situation considerably better. Therefore, in a first preferred embodiment according to the invention, a current measured value and calculated trend information are used to determine a time period after which the measured parameter, such as the glucose concentration, will have reached a specific measured value. In the second embodiment, a current measured value and calculated trend information are used to determine a measured

value and/or a subrange associated with this, which the measured parameter, such as the glucose concentration, will have reached after a specific time period. The calculated measured values in this case depend on the subdivision of the measured value range.

**[0016]** The current subrange, the time period until the subrange is left and the next subrange which will be reached after the current subrange has been left are in this case preferably displayed at the same time. This form of display of the method according to the invention allows the patient to assess his situation particularly well because all of the data required for this assessment can be checked at a glance.

**[0017]** In a further embodiment, which does not form part of the invention, a defined time period, a current measured value and calculated trend information are also used to predict the glucose concentration at the end of the time period. This predicted glucose concentration is in this case associated with a subrange in the plan and is indicated.

**[0018]** It is likewise feasible to display individual ones of the three components mentioned above on their own or in conjunction with just one further component, such as an indication of the current subrange together with the time period before this subrange will have been left.

**[0019]** The measured value range is advantageously subdivided into different subranges with the assistance of specific limit, threshold or target values for the measured parameter. For example, the glucose limit concentrations for hypoglycaemia and hyperglycaemia mark sensible values for subdivision of the measured value range since they are associated with specific body states which are relevant for diabetes therapy purposes. The patient can therefore tell particularly quickly whether he is in a healthy state, or his blood glucose concentration is too high or too low.

**[0020]** Alternatively, the measured value range can also be subdivided on the basis of other criteria. For example, the measured value range can be subdivided into subranges of uniform size and with uniform distribution, which are not based on any medically therapeutic principle, but purely, for example, on a numerical principle.

**[0021]** Furthermore, one particularly preferred embodiment of the invention allows user-controlled and user-defined subdivision of the measured value range into individual subranges. This allows the method to be used more flexibly, by the capability of matching widely different requirements, medical situations and individual characteristics.

**[0022]** However, the subdivision of the measured value range can also be preset, this not being disadvantageous in situations in which specific limit, threshold and target values are not distinguished individually, but are generally applicable. This may be the case in particular for absolute limit and threshold values.

**[0023]** The trend calculation is preferably carried out by evaluation of at least two measured values at different times, in particular by filtering with an output or calculation

on a first time derivative or by a first derivative of a function which is matched to the measured values, preferably using a Kalman filter or a spline function. For trend calculation of individual measurement points, it is worthwhile considering two measured values at different times, and making a prediction of subsequent measured values from the development of the measured values. If a sufficiently large number of measured values and an adequate value density are available, it is also worthwhile describing the profile of the measured values by a function which is matched to the values. One preferred function such as this is a spline function. The functional relationship between measurement values and the time of the measurement allows derivation of the function which describes this relationship, and is advantageously used for trend calculation.

**[0024]** It is also possible to use other methods that are known in principle for measured value approximation by means of one or more functional relationships. These may vary depending on the application, to the extent that adaptations may be required which on the one hand are particularly accurate and computation intensive and, in contrast to this, on the other hand are particularly fast and efficient.

**[0025]** The trend calculation can also advantageously take account of a measured value profile which is higher than the first derivative and in particular using suitable filter algorithms or a function which approximates the measured values. The assumption of a constant trend, which is implicitly included in the use of the first derivative of a function, can be weakened by consideration of further derivatives. This leads to a further improvement in the prediction accuracy.

**[0026]** However, if there are only small variations in the trend, it might also be worthwhile using only the first derivative, or a trend indication determined in some other way, ignoring the additional influences such as those described by a second derivative, since this involves less computation effort. The greater the time period over which data is recorded for trend calculation, the more accurate the resultant predictions may be.

**[0027]** If a large number of measured values are recorded, it is possible to estimate more accurately how stable the profile of the measured parameter is and the discrepancies which must be expected in the trend details. An estimate such as this can therefore provide an error to be expected in the prediction and can therefore form a good basis for the decision on the required computation complexity. The length of the time period over which the data is recorded may, for example, depend on the width of the individual subranges of the measured value range if, for example, measured values remain in a wide subrange with the same value development for longer than in a narrow subrange.

**[0028]** Subdivision of the measured value range into physiologically relevant subranges has the advantage that this allows a warning to be provided on the basis of the calculated time period before a corresponding sub-

range is entered, before this occurs. In many cases, for example, the physiological glucose value ranges such as the hypoglycaemic or hyperglycaemic ranges resulting in an alarm, for example, must be avoided in any case while, in contrast, the precise profile of the glucose value within the physiologically non-critical range is of secondary importance.

**[0029]** An additional subdivision of a physiologically non-critical range into further subranges is, however, likewise advantageous to allow a patient to assess his situation more accurately. This may be based on more stringent requirements for a patient to check his glucose concentration and thus to narrow the margin of the glucose concentrations that are classified as "good", without indicating a dangerous situation.

**[0030]** The emission of a warning, for example by an alarm transmitter, at a time before a defined value, and in particular a critical value, of a measured parameter, for example a glucose concentration, is reached is also advantageous. In this case, in particular, the warning may be emitted without any active check. The emission of a warning based, for example, on audible means also informs the user of critical situations in good time without any regular active check. It is likewise possible to emit an appropriate warning in response to an active check, in order to underline the importance of the output value.

**[0031]** It is likewise feasible for a warning to be emitted during and after a defined and in particular a critical value of a measured parameter is reached. This avoids the need for a prior warning time period. A prior warning period in the form of "virtual critical" values could be provided on reaching defined values which are adjacent to critical values but are not yet in their own right critical. This warning can also be provided visually, for example by colouring the display of the subranges using green, yellow and red for "non-critical", "virtually critical" and "critical" subranges. If no warning is emitted, it is the responsibility and the problem of the user to regularly check the measured parameter and its predicted trend.

**[0032]** A request for corrective action can advantageously be produced before the defined value, in particular the critical value, is reached. This request may be coupled to the emission of a warning, or may be independent of it. The request for a corrective action is accompanied, in addition to indication of an imminent defined or critical value, by information that the patient should take measures to avoid a critical value. The request for corrective action may also include information as to how it is possible to avoid reaching the critical value. In this case, options include not only general advice such as "reduce your glucose concentration" but also a proposal for a specific action such as "give yourself an insulin bolus of quantity X" or "consume an amount X of carbohydrates".

**[0033]** The request for a corrective action is particularly worthwhile when the physiological situation would deteriorate significantly if a defined value were to be reached, overshoot or undershoot, in the sense of a medically critical

state. The need for a corrective action is implicitly signalled to the patient just by the indication of the current physiological situation and its expected development. An explicit request should in fact therefore be regarded as a further feature to assist the patient.

**[0034]** An apparatus for carrying out a method which can be described as above comprises a measurement apparatus for continuous measurement or feeding of a parameter which is measured on or in a human body, in particular a glucose concentration. The invention also comprises a system controller having a computer for the calculation of trend information about the future expected profile of the measured parameter, and for production of a prediction for a result value based on an input value, in particular such as a time period within which the measured parameter will reach a predeterminable value. The system controller also includes a memory unit for storage of the measured value range subdivision, the parameters and measured values fed in and, furthermore, a display. In this case, the system controller is designed and programmed such that the measured value range of the measurement apparatus can be subdivided into at least two subranges, and such that a result value, in particular a time period after which it is predicted that the measured parameter will have left its current subrange can be determined. In this case, the result value is determined on the basis of the current value of the measured parameter, the calculated trend information and the input value. In this case, the determined result value can be output via the display.

**[0035]** The apparatus according to the invention advantageously comprises all the abovementioned elements in order to allow it to operate as a functional unit. At least the system controller must be able to have or address appropriate input and output apparatuses. It is therefore not absolutely essential for a measurement apparatus to be part of the apparatus according to the invention. However, an apparatus must be provided to allow a parameter to be fed in. An analogous situation applies to the output of the data which in fact preferably controls a display contained in the apparatus according to the invention. However, in principle, all that is required is an apparatus for transmission of data to a display unit, in particular an external display unit.

**[0036]** The abovementioned apparatus advantageously has an input apparatus which allows a user to interact with the system controllers. An input apparatus such as this extends the range of application of the apparatus to those methods which envisage interaction with the user and can or must be individually adapted.

**[0037]** Without an input apparatus, the system controller must be set in a relatively general form in order to largely comply with the needs of every user. It may also be advantageous to allow only specific data items to be edited by a user, specifically those data items which differ individually, in contrast to data or settings such as limit and threshold values, which are considered to be generally applicable.

**[0038]** Furthermore, the abovementioned apparatus may preferably include an alarm transmitter which warns a user before a defined and in particular critical value of the measured parameter is reached. A warning such as this may also be emitted by means of the alarm transmitter without any active check by the user. An alarm transmitter which is provided in addition to a display relieves the user of the task of regularly checking the apparatus and actively monitoring whether, for example, the glucose concentration is approaching a critical value.

**[0039]** A computer program product which processes data from a measurement, which is carried out continuously on or in a human body, of a parameter, may be used to carry out one of the methods mentioned above. In this case, the measured parameter may, in particular, describe a glucose concentration. Furthermore, the measured value range of the measured parameter is subdivided into subranges, and trend information about the future expected profile of the measured parameter is calculated from the measured data. A result value, in particular a time period after which it is predicted that the measured parameter will have left its current subrange is determined, based on a current value of the measured parameter, the calculated trend information and a predeterminable input value. This determined result value is then provided as the output.

**[0040]** Further advantageous embodiments and feature combinations of the invention will become evident from the following detailed description and the totality of the patent claims.

#### Brief description of the drawings

**[0041]** In the drawings which will be used to explain the exemplary embodiment:

- Figure 1 shows an illustration in the form of a graph of the measured value range, subdivided into subranges, with a falling trend;
- Figure 2 shows an illustration in the form of a graph of the measured value range, subdivided into subranges, with a rising trend;
- Figure 3 shows an illustration in the form of a graph of the measured value range, subdivided into subranges, without any identifiable rising or falling trend;
- Figure 4 shows a text display of the measured value range, subdivided into subranges, for a falling trend;
- Figure 5 shows a number display of the measured value range, subdivided into subranges, for a falling trend; and
- Figure 6 shows an apparatus for carrying out a method for visualization of a parameter which is measured on or in a human body.

**[0042]** Fundamentally, identical parts are provided with the same reference symbols in the figures.

### Approaches to implementation of the invention

**[0043]** Figure 1 shows a measured value range 1, which is subdivided into subranges 1.1 - 1.5, for measurement of a parameter which is measured on or in a human body, in particular a glucose concentration in a person's blood emphasizing a subrange 1.2 in which the current measured value is located. The illustration in the form of a graph of the measured value in this form directly indicates to a patient where the current measured value can be positioned with respect to the entire measured value range. In addition, a second measured value range 2 is shown, which is likewise subdivided into subranges 2.1 - 2.5 and in which the subrange 2.3 is emphasized, in which the predicted measured value, for example the glucose concentration, will next occur. Each of the subranges 1.1 - 1.5, 2.1 - 2.5 indicates an interval of the entire measured value range 1, 2, with the respective subrange 1.2, 2.3 within which the result of the current or a future measurement, respectively, is or will be, being emphasized in the graph. The two illustrations of the measured value ranges 1 and 2 show the same measured value range, which has also been subdivided in the same way, at different times. In this case, the measured value range 1 forms an illustration of the current measurement, while in contrast to this the measured value range 2 shows a predicted measurement with the same subdivision. An arrow 3 in Figure 1 is also shown between the emphasized subranges, illustrating the fact that the glucose concentration will change towards lower values. Furthermore, the time 4 of 20 minutes is indicated, for which the change from the current subrange 1.2 to the other subrange 2.3 is predicted. The indication of the time period makes it possible for the patient to estimate his physiological situation particularly well because, in contrast to medical or technical details, time periods are known from daily life by any average patient.

**[0044]** In a first operating mode, a time 4 before the condition occurs is determined and indicated on the basis of a current value of the measured parameter, which is associated with a first subrange 1.2, and the calculated trend information, and subject to the condition that the measured parameter will leave the current subrange and will reach a second subrange.

**[0045]** In a second operating mode, not forming part of the invention, a predicted value of the measured parameter is determined on the basis of a current value of the measured parameter which is associated with a first subrange 1.2, and the calculated trend information and subject to the condition that a specific time 4 will pass, and this measured parameter is associated with a second subrange 2.3. In this case, the subranges and the time period are displayed analogously to the first operating mode, in which a time 4 is calculated for which a change in the measured parameter from a first subrange 1.2 to a second subrange 2.3 is predicted.

**[0046]** Figure 2 likewise shows a measured value range 1, which is subdivided into subranges 1.1 - 1.5, of

the measurement for example of the glucose concentration in a person's blood, with the subrange 1.3 within which the current measured value is located being emphasized. Figure 2 also shows a second measured value range 2 which is subdivided into subranges 2.1 - 2.5 and in which the subrange 2.2 within which the predicted glucose concentration will occur is emphasized. As in Figure 1, an arrow 3 is also shown between the measured value ranges 1 and 2 in this case, indicating that the glucose concentration will rise. The time 4 of 10 minutes which is predicted before the change between the subranges 1.3 and 2.2 will occur, or which is defined as the prediction time period, is also indicated.

**[0047]** If the system according to the invention does not find any clearly rising or falling trend in the glucose concentration, but predicts a stagnation in the glucose concentration, the arrow 3 neither rises nor falls, but is aligned horizontally, as illustrated in Figure 3. The indication of a time after which a change in the subrange would occur is in this case obviously not worthwhile. The time indication can therefore be omitted when the glucose concentration is constant, or can be replaced by information corresponding to the situation. The time when the glucose concentration is considered to be constant depends on an entered or preset maximum time. Time periods for the change between adjacent subranges which are greater than this minimum time by definition lead to a classification of the trend as constant. The choice of the maximum time may in this case depend on the individual patient, or else be predetermined.

**[0048]** In addition to the display as has been demonstrated in the previous figures, the measurement of a parameter can also be displayed in the form of text, for example in the case of the glucose concentration. A text display of this kind is shown in Figure 4. Figure 4 shows an actual state "high" 5 and a predicted state "target range" 7, for which the time 6 of 30 minutes has been calculated in order to reach the state 7, and this is likewise indicated. In particular, the text display is intended to be able to display information at a qualitatively descriptive level. As an alternative to a text display, easily comprehensible symbols, in particular Smileys, can also be used. This may be particularly advantageous when a diagrammatic representation as in Figures 1 to 3 would be rather confusing for patients or when only small-format display units are available. In addition, the text display is also very highly suitable for making statements about the physiological state of the patient from the medical point of view, such as "critical" or "normal" etc.

**[0049]** Figure 5 shows a numerical display of the measured glucose concentration and of the predicted trend of the glucose concentration. An actual state 8 of 80 mg/dl is indicated as the objective value. The predicted state 10 of 50 mg/dl with "hypo" as an indication of critical hypoglycaemia is indicated alongside this, and provides assistance to the patient, particularly in critical situations in interpretation of the numerical value. The time 9 of 30 minutes which will pass, according to the calculations,

before the predicted state 10 is reached, is likewise displayed.

**[0050]** Both the text display and the numerical display or pure graphical reproduction of the information relating to the measured and the predicted glucose concentration additionally offer the capability to output an alarm. This alarm may preferably be output in audible form, or in audible and visual form. In particular, visualizations such as flashing symbols, the use of warning colours, particularly large or conspicuous characters or the like, are particularly suitable as a visual alarm. Audible warnings can be provided by emitting a warning signal, in particular in the form of a sequence of different tones or an intensive continuous tone. In this case as well, it is possible to use in principle known audible warning mechanisms.

**[0051]** It is particularly useful in this context to emit a proposal for a countermeasure, in order to prevent the occurrence of a critical situation. In particular, this may be coupled to the emission of an alarm. Together with information about a critical situation, a corrective action to avoid this situation can therefore be proposed, such as giving a specific dose of insulin or ending a stressful or potentially hazardous activity of the patient, for example sport or car driving. Figure 6 shows an apparatus according to the invention. A continuously operating measurement apparatus 11 measures a parameter on or in a human body, in particular a glucose concentration. The measurement apparatus 11 feeds the recorded data to a system controller 12 which contains at least one computer 14 for calculation of trend information from the previous profile of the measured parameter, possibly assisted by the input of additional information, in particular diabetes-relevant information such as meal times or insulin boluses, and for production of a prediction for a time period within which the measured parameter will vary by a predetermined value. The system controller 12 also includes a memory unit 15 for storage of the measured value range subdivision and of the parameters and measured values fed in. The system controller 12 reproduces the calculated and processed data on a display 13, which on the one hand displays a current measured value and on the other hand a predicted measured value, as well as a time which it is predicted will pass before the predicted measured value is reached.

**[0052]** The apparatus illustrated in Figure 6 also has an input apparatus 16 by means of which a user can influence, vary and/or enter a number of functions of the apparatus, as well as individual parameters. Inter alia, the variable functions may be the recordings of data and its storage as well as the input of parameters for the calculations, in particular the desired accuracy of the calculation. The subdivision of the measured value range into subranges and the display form of the recorded and calculated data and possible limit, target or threshold values of the measured parameter, for example of the glucose concentration, furthermore represent further variable parameters. In addition, the apparatus has an alarm transmitter 17 which can make the user aware of an imminent

critical situation, for example by audible or visual signals. For this purpose it can output a signal, for example, a specific time before a critical situation is reached, that is to say for example before a subrange is reached with contains critical glucose concentrations. Critical glucose concentrations such as these may in particular be those which indicate hyperglycaemia or hypoglycaemia. Because the apparatus according to the invention is able to calculate a relatively accurate prediction about an expected development of the glucose concentration, it can be used to provide a sufficiently early warning of the occurrence of a critical glucose concentration.

**[0053]** Ideally, a warning such as this is provided at a time which can be understood by a patient. This can be done in some cases by observation of the development of the trend of the glucose concentration, because a change in the trend can lead to the deduction of a physiologically relevant event. If the currently measured glucose concentration is in a subrange which is adjacent to a critical subrange, a change in the trend towards this critical subrange will lead to a warning being emitted. In this case, this warning is preferably emitted irrespective of a check by the patient. This will at least make the patient more aware of the situation. The request for a corrective action could even make it possible for a patient in this way at least to survive critical physiological situations.

**[0054]** In addition to the abovementioned displays in the form of text, numerical and graphics displays, these elements may also be combined as required. For example, it may be particularly helpful to couple a graphical display to the measured values. This makes it possible for the patient on the one hand to use the graphical display to obtain an intuitively qualitative assessment of his physiological situation, and on the other hand to use the numerical display to also obtain a quantitative assessment of his physiological situation.

**[0055]** In addition, a useful modification of the abovementioned exemplary embodiments is an additional display of therapy-relevant information alongside the measured parameters. Specifically, this may be the time, the time which has passed since then and the nature of the most recently recorded meal times, the time, the time which has passed since then, and the amount of an insulin bolus or a physical activity, both its nature and duration. In this case, the system may know therapy-relevant information, or this can be entered by the user or can be notified to the system.

**[0056]** With regard to the arrows in the graphical display of the trend of the glucose concentration, it is, of course, also possible to distinguish the gradient according to the invention, since this represents the rate of change of the glucose concentration, for example, qualitatively, as is also known from the prior art. This measure is used to assist the perception of the trend of the glucose concentration by the user. The quantitative display in the form of a time period is, however, a major factor for the purposes of the invention. In this case, this quantitative

display may assume various forms in addition to being displayed as the time still remaining in minutes or seconds. Possible examples relating to this are a digital or analogue display of the time at which the change between the subranges will take place. Furthermore, the display could be in the form of an hourglass, or a moving bar.

**[0057]** In summary, it can be stated that the invention provides a method and an apparatus which allow a patient to assess the expected development of his current physiological situation. The solution is based on the calculation and display of a result value, in particular a time period, after which a measured parameter will change from one subrange to another, or of a subrange which the measured parameter will reach after a predetermined time period. It is possible for the patient to assess the effects of his action at a time that he can comprehend and on the basis of the predictions available to him, and if appropriate to take corrective actions, without any detailed knowledge of medical relationships.

## Claims

1. Method for visualization of a parameter which is measured continuously on or in a human body, in particular a glucose concentration, comprising the following steps:
  - a) subdividing a measured value range (1, 2) for the measured parameter into two or more subranges (1.1 - 1.5, 2.1 - 2.5);
  - b) calculation of trend information relating to the future expected profile of the measured parameter on the basis of two or more measured values;
  - c) determination of a result value;
  - d) the result value is determined, based on a current value of the measured parameter, the calculated trend information and a definable input value, where the result value and the input value are different quantities, the definable input value being a subrange (1.1 - 1.5, 2.1 - 2.5) and the result value to be determined being a time period (4) after which the measured parameter has left or reached the definable subrange (1.1 - 1.5, 2.1-2.5); **characterised by** :
    - e) display of the determined result value;
    - f) the current subrange (1.2, 1.3), the time period until this subrange (4) is left and a next subrange (2.2, 2.3) which will be reached after leaving the current subrange are displayed at the same time.
2. Method according to Claim 1, **characterized in that** the calculation of trend information over the future expected profile of the measured parameter on the basis of two or more measured values includes additional information relating to events which influence the measured parameter.
  3. Method according to one of Claims 1 or 2, **characterized in that** the measured value range (1, 2) is subdivided into subranges (1.1 - 1.5, 2.1 - 2.5) by means of limit, threshold and target values of the measured parameter.
  4. Method according to one of Claims 1 to 3, **characterized in that** the measured value range (1, 2) can be subdivided into subranges (1.1 - 1.5, 2.1 - 2.5) by a user.
  5. Method according to one of Claims 1 to 4, **characterized in that** the trend calculation is carried out by evaluation of at least two measured values at different times, in particular by means of suitable filter algorithms or a first derivative of a function which is matched to the measured values, preferably a spline function.
  6. Method according to one of Claims 1 to 5, **characterized in that** a function which is higher than the first derivative of the measured value profile, preferably using suitable filter algorithms, or a function which is matched to the data points, preferably a spline function, is included in the trend calculation.
  7. Method according to one of Claims 1 to 6, **characterized in that** the measured value range (1, 2) is subdivided into physiologically relevant subranges (1.1 - 1.5, 2.1 - 2.5).
  8. Method according to one of Claims 1 to 7, **characterized in that** a warning is emitted in particular independently of an active check, at a time before a defined, in particular critical, value of the measured parameter is reached.
  9. Method according to Claim 8, **characterized in that** a request for a corrective action is emitted at a time before the defined, in particular, critical, value of the measured parameter is reached.
  10. Apparatus for carrying out a method according to one of Claims 1 to 9, **characterized in that** the apparatus comprises the following:
    - a) a measurement apparatus (11) for continuous measurement or feeding of a parameter which is measured on or in a human body, in particular a glucose concentration,
    - b) a system controller (12) having
      - a computer (14) for the calculation of trend Information about the future expected profile of the measured parameter and for determination of a result value, and

- a memory unit (15) for storage of the measured value range subdivision, parameters fed in and measured values; and
- c) a display (13): 5
- with the system controller (12) being designed and programmed such that
- d) the measured value range (1, 2) of the measurement apparatus can be subdivided into at least two subranges (1.1 - 1.5, 2.1 - 2.5); wherein the system controller (12) being further designed and programmed such that 10
- e) the result value can be determined on the basis of a current value of the measured parameter, the calculated trend information and the definable input value, where the result value and the input value are different quantities, the definable input value being a subrange (2.1 - 2.5) and the result value to be determined being a time period (4) after which the measured parameter has left or reached the definable subrange (1.1 - 1.5, 2.1-2.5) 15
- characterized in that**
- f) the determined result value can be output via the display (13); and 20
- g) the current subrange (1.2, 1.3), the time period until this subrange (4) is left and a next subrange (2.2, 2.3) which will be reached after leaving the current subrange are displayed at the same time on the display (13). 25
11. Apparatus according to Claim 10, **characterized by** an input apparatus (16) for interaction between a user and the system controller (12). 35
12. Apparatus according to one of Claims 10 or 11, **characterized in that** the apparatus also includes an alarm transmitter (17) which warns a user before a defined, in particular critical, value of the measured parameter is reached. 40
13. Computer program product for carrying out the method according to one of Claims 1 to 9, **characterized in that** 45
- a) data is processed from a measurement, which is carried out continuously on or in a human body, of a parameter, in particular a glucose concentration, 50
  - b) a measured value range (1, 2) of the measured parameter is subdivided into subranges (1.1 - 1.5, 2.1 - 2.5),
  - c) trend information about the future expected profile of the measured parameter is calculated from the measured data, 55
  - d) a result value is determined based on a cur-

rent value of the measured parameter, the calculated trend information and the definable input value, where the result value and the input value are different quantities, the definable input value being a subrange (2.1 - 2.5) and the result value to be determined being a time period (4) after which the measured parameter has left or reached the definable subrange (1.1 - 1.5, 2.1-2.5),

**characterized in that**

e) the current subrange (1.2, 1.3), the time period until this subrange (4) is left and a next subrange (2.2, 2.3) which will be reached after leaving the current subrange are provided as output.

### Patentansprüche

1. Verfahren zur Visualisierung eines Parameters, der ständig an oder in einem menschlichen Körper gemessen wird, insbesondere eine Glukosekonzentration, umfassend die folgenden Schritte:
  - a) Unterteilen eines Messwertbereichs (1, 2) für den gemessenen Parameter in zwei oder mehr Teilbereiche (1.1 - 1.5, 2.1 - 2.5);
  - b) Berechnung von Trendinformationen bezüglich des zukünftigen erwarteten Profils des gemessenen Parameters auf der Basis von zwei oder mehr Messwerten;
  - c) Bestimmen eines Resultatwerts;
  - d) der Resultatwert wird auf der Basis eines aktuellen Werts des gemessenen Parameters, der berechneten Trendinformationen und eines definierbaren Eingangswerts bestimmt, wobei der Resultatwert und der Eingangswert unterschiedliche Größen sind, der definierbare Eingangswert ein Teilbereich (1.1 - 1.5, 2.1 - 2.5) ist und der zu bestimmende Resultatwert eine Zeitperiode (4) ist, nach der der gemessene Parameter den definierbaren Teilbereich (1.1 - 1.5, 2.1 - 2.5) verlassen hat oder erreicht hat; **gekennzeichnet durch:**
  - e) Anzeige des bestimmten Resultatwerts;
  - f) wobei der aktuelle Teilbereich (1.2, 1.3), die Zeitperiode, bis dieser Teilbereich (4) verlassen worden ist, und ein nächster Teilbereich (2.2, 2.3), der nach dem Verlassen des aktuellen Teilbereichs erreicht wird, zur gleichen Zeit angezeigt werden.
2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Berechnung von Trendinformationen über das zukünftige erwartete Profil des gemessenen Parameters auf der Basis von zwei oder mehr Messwerten zusätzliche Informationen bezüglich Ereignissen beinhaltet, die den gemessenen Parameter beeinflussen.

3. Verfahren nach einem der Ansprüche 1 oder 2, **dadurch gekennzeichnet, dass** der Messwertbereich (1, 2) mit Hilfe von Grenz-, Schwellwert- und Zielwerten des gemessenen Parameters in Teilbereiche (1.1 - 1.5, 2.1 - 2.5) unterteilt wird. 5
4. Verfahren nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** der Messwertbereich (1, 2) von einem Benutzer in Teilbereiche (1.1-1.5, 2.1 - 2.5) unterteilt werden kann. 10
5. Verfahren nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** die Trendberechnung durch Evaluation von mindestens zwei Messwerten zu verschiedenen Zeiten ausgeführt wird, insbesondere mit Hilfe von geeigneten Filteralgorithmen oder einer ersten Ableitung einer Funktion, die an die Messwerte angepasst ist, bevorzugt eine Spline-Funktion. 15
6. Verfahren nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** eine Funktion, die über der ersten Ableitung des Messwertprofils liegt, bevorzugt unter Verwendung geeigneter Filteralgorithmen, oder eine Funktion, die an die Datenpunkte angepasst ist, bevorzugt eine Spline-Funktion, in der Trendberechnung enthalten ist. 20
7. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** der Messwertbereich (1, 2) in physiologisch relevante Teilbereiche (1.1 - 1.5, 2.1 - 2.5) unterteilt wird. 25
8. Verfahren nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** eine Warnung insbesondere unabhängig von einer aktiven Prüfung zu einer Zeit emittiert wird, bevor ein definierter, insbesondere kritischer, Wert des gemessenen Parameters erreicht wird. 30
9. Verfahren nach Anspruch 8, **dadurch gekennzeichnet, dass** eine Aufforderung für eine korrigierende Aktion zu einer Zeit emittiert wird, bevor der definierte, insbesondere kritische, Wert des gemessenen Parameters erreicht wird. 35
10. Vorrichtung zum Ausführen eines Verfahrens nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass** die Vorrichtung Folgendes umfasst: 40
- a) eine Messvorrichtung (11) zur ständigen Messung oder Speisung eines Parameters, der an oder in einem menschlichen Körper gemessen wird, insbesondere eine Glukosekonzentration, 45
- b) einen Systemcontroller (12) mit
- einem Computer (14) für die Berechnung von Trendinformationen über das zukünftige erwartete Profil des gemessenen Parameters und zur Bestimmung eines Resultatwerts und
  - einer Speichereinheit (15) für die Speicherung der Messwertbereichsunterteilung, eingespeicherter Parameter und Messwerte; und
- c) ein Display (13): wobei der Systemcontroller (12) so ausgelegt und programmiert ist, dass
- d) der Messwertbereich (1, 2) der Messvorrichtung in mindestens zwei Teilbereiche (1.1 - 1.5, 2.1 - 2.5) unterteilt werden kann; wobei der Systemcontroller (12) weiterhin derart ausgelegt und programmiert ist, dass
- e) der Resultatwert kann auf der Basis eines aktuellen Werts des gemessenen Parameters, der berechneten Trendinformationen und des definierbaren Eingangswerts bestimmt werden, wobei der Resultatwert und der Eingangswert unterschiedliche Größen sind, der definierbare Eingangswert ein Teilbereich (2.1 - 2.5) ist und der zu bestimmende Resultatwert eine Zeitperiode (4) ist, nach der der gemessene Parameter den definierbaren Teilbereich (1.1 - 1.5, 2.1 - 2.5) verlassen hat oder erreicht hat; **dadurch gekennzeichnet, dass**
- f) der bestimmte Resultatwert über das Display (13) ausgegeben werden kann; und
- g) der aktuelle Teilbereich (1.2, 1.3), die Zeitperiode, bis dieser Teilbereich (4) verlassen worden ist, und ein nächster Teilbereich (2.2, 2.3), der nach dem Verlassen des aktuellen Teilbereichs erreicht wird, zur gleichen Zeit auf dem Display (13) angezeigt werden.
11. Vorrichtung nach Anspruch 10, **gekennzeichnet durch** eine Eingabevorrichtung (16) zur Interaktion zwischen einem Benutzer und dem Systemcontroller (12). 50
12. Vorrichtung nach einem der Ansprüche 10 oder 11, **dadurch gekennzeichnet, dass** die Vorrichtung auch einen Alarmsender (17) enthält, der einen Benutzer warnt, bevor ein definierter, insbesondere kritischer, Wert des gemessenen Parameters erreicht wird. 55
13. Computerprogrammprodukt zum Ausführen des Verfahrens nach einem der Ansprüche 1 bis 9, **dadurch gekennzeichnet, dass**
- a) Daten aus einer Messung, die kontinuierlich an oder in einem menschlichen Körper ausgeführt wird, eines Parameters, insbesondere einer Glukosekonzentration, verarbeitet werden,

b) ein Messwertbereich (1, 2) des gemessenen Parameters in Teilbereiche (1.1 - 1.5, 2.1 - 2.5) unterteilt wird,  
 c) Trendinformationen über das zukünftige erwartete Profil des gemessenen Parameters an Hand der Messdaten berechnet werden,  
 d) ein Resultatwert auf der Basis eines aktuellen Werts des gemessenen Parameters, der berechneten Trendinformationen und eines definierbaren Eingangswerts bestimmt wird, wobei der Resultatwert und der Eingangswert unterschiedliche Größen sind, der definierbare Eingangswert ein Teilbereich (2.1 - 2.5) ist und der zu bestimmende Resultatwert eine Zeitperiode (4) ist, nach der der gemessene Parameter den definierbaren Teilbereich (1.1 - 1.5, 2.1 - 2.5) verlassen hat oder erreicht hat,  
**dadurch gekennzeichnet, dass**  
 e) der aktuelle Teilbereich (1.2, 1.3), die Zeitperiode, bis dieser Teilbereich (4) verlassen wird, und ein nächster Teilbereich (2.2, 2.3), der nach dem Verlassen des aktuellen Teilbereichs erreicht wird, als Ausgabe bereitgestellt werden.

## Revendications

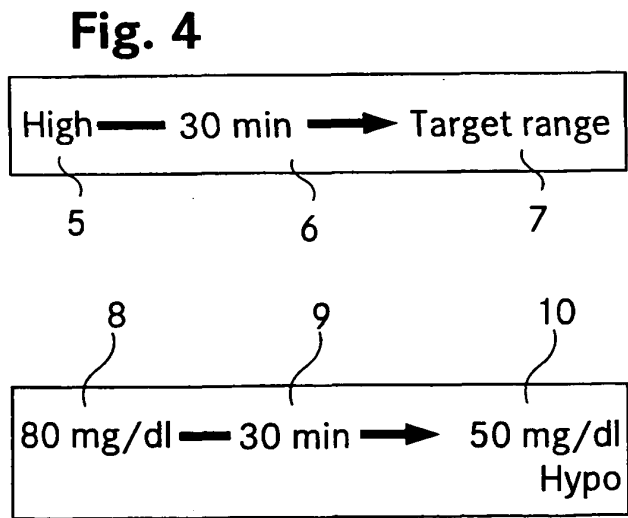
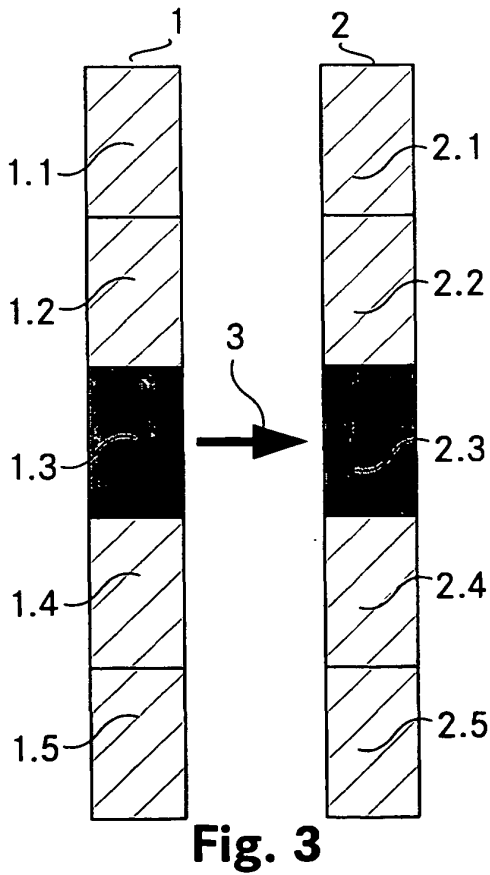
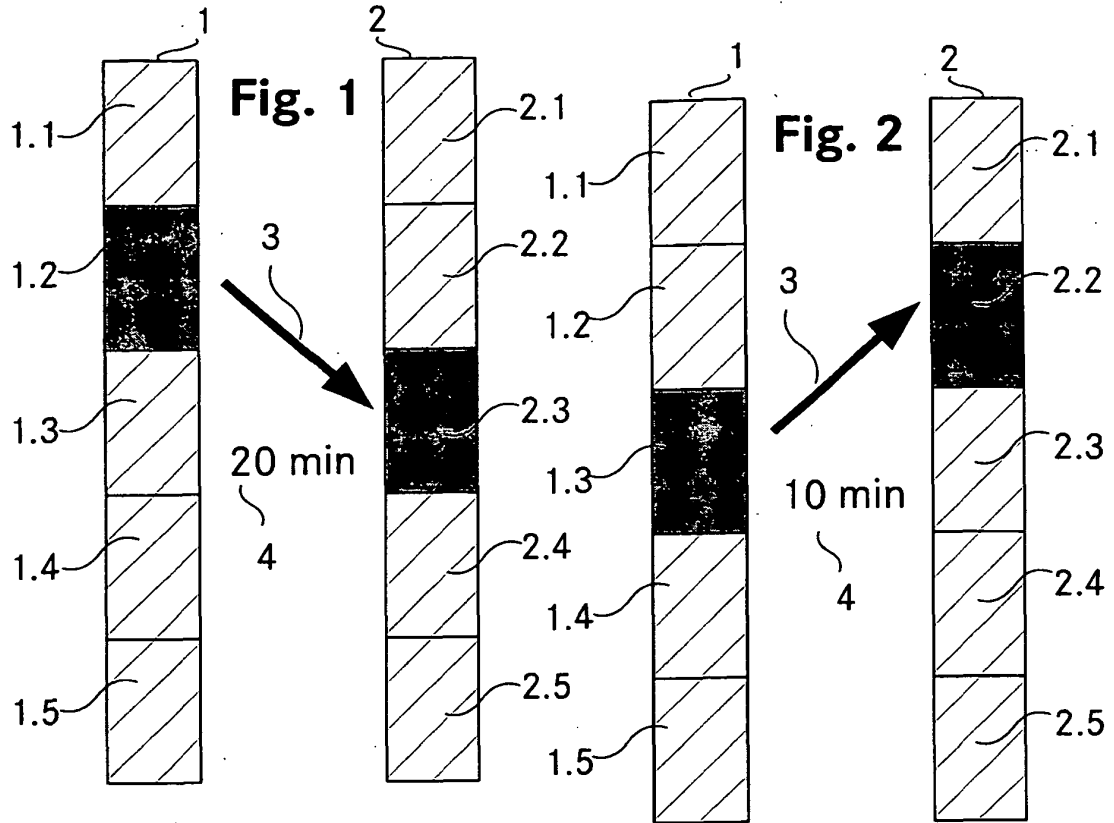
1. Procédé de visualisation d'un paramètre qui est mesuré continuellement sur ou dans un corps humain, notamment la concentration de glucose, consistant à :
  - a) sous-diviser une plage de valeurs mesurées (1, 2) pour le paramètre mesuré en deux sous-plages ou plus (1.1-1.5 ; 2.1-2.5) ;
  - b) calculer des informations de tendance concernant le profil futur escompté du paramètre mesuré en fonction de deux valeurs mesurées ou plus ;
  - c) déterminer une valeur de résultat ;
  - d) déterminer la valeur de résultat en fonction d'une valeur courante du paramètre mesuré, des informations de tendance calculées et d'une valeur d'entrée définissable, la valeur de résultat et la valeur d'entrée étant des quantités différentes, la valeur d'entrée définissable étant une sous-plage (1.1-1.5 ; 2.1-2.5) et la valeur de résultat à déterminer étant une période de temps (4) après laquelle le paramètre mesuré a quitté ou atteint la sous-plage définissable (1.1-1.5 ; 2.1-2.5) ; **caractérisé par** :
  - e) l'affichage de la valeur de résultat déterminée ;
  - f) l'affichage au même moment de la sous-plage courante (1.2, 1.3), de la période de temps écoulée jusqu'à ce que cette sous-plage (4) soit quittée et d'une sous-plage suivante (2.2, 2.3) qui sera atteinte après avoir quitté la sous-plage

courante.

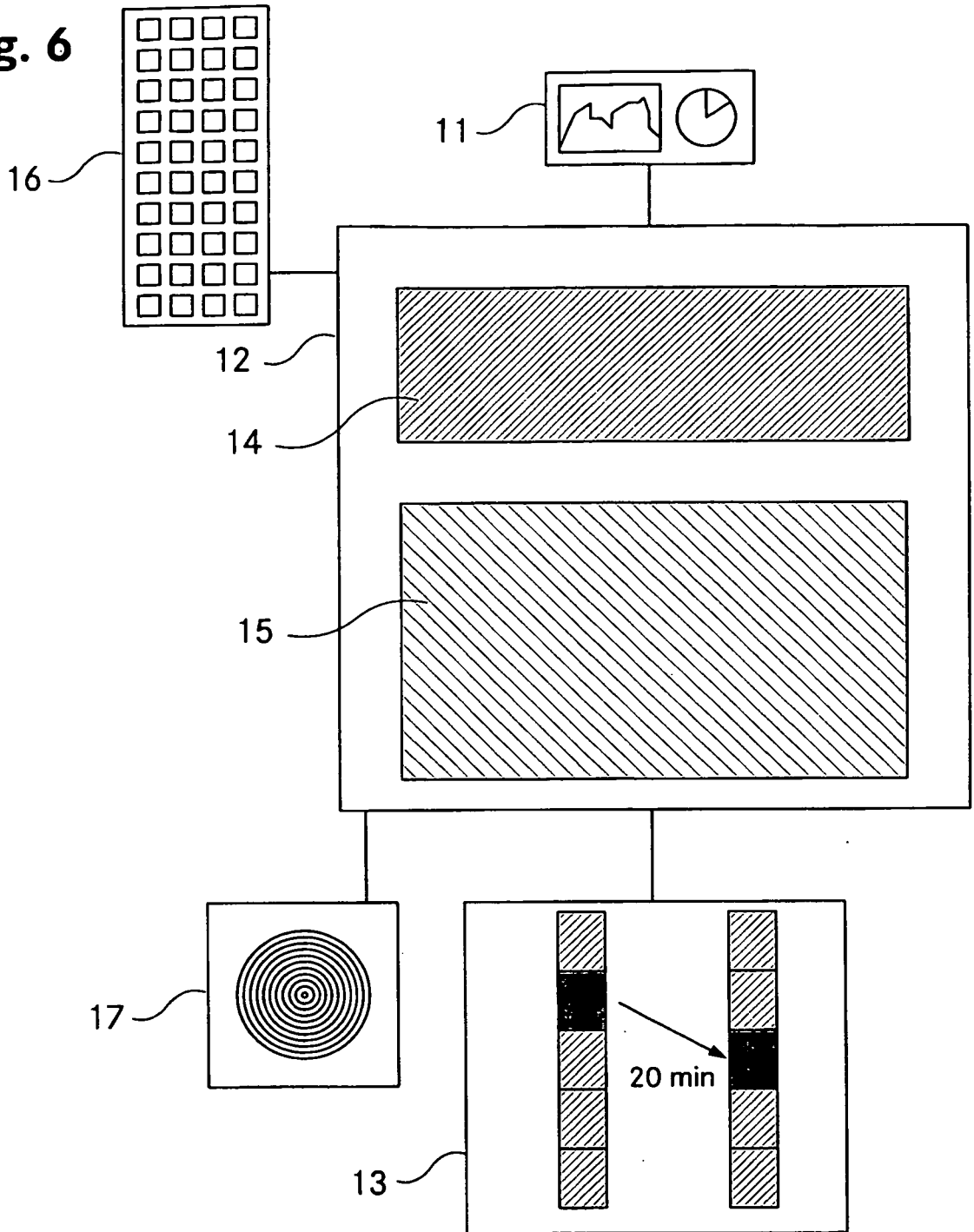
2. Procédé selon la revendication 1, **caractérisé en ce que** le calcul des informations de tendance sur le profil futur escompté du paramètre mesuré en fonction de deux valeurs mesurées ou plus comprend des informations supplémentaires concernant des événements qui influencent le paramètre mesuré.
3. Procédé selon l'une des revendications 1 ou 2, **caractérisé en ce que** la plage de valeurs mesurées (1, 2) est sous-divisée en sous-plages (1.1-1.5, 2.1-2.5) par le biais de valeurs limite, seuil et cible du paramètre mesuré.
4. Procédé selon l'une des revendications 1 à 3, **caractérisé en ce que** la plage de valeurs mesurées (1, 2) peut être sous-divisée en sous-plages (1.1-1.5, 2.1-2.5) par un utilisateur.
5. Procédé selon l'une des revendications 1 à 4, **caractérisé en ce que** le calcul de tendance est effectué par l'évaluation d'au moins deux valeurs mesurées à des moments différents, notamment à l'aide d'algorithmes de filtrage appropriés ou d'une première dérivée d'une fonction qui est mise en correspondance avec les valeurs mesurées, de préférence une fonction spline.
6. Procédé selon l'une des revendications 1 à 5, **caractérisé en ce qu'**une fonction qui est supérieure à la première dérivée du profil de valeur mesurée, de préférence en utilisant des algorithmes de filtrage appropriés, ou une fonction qui est mise en correspondance avec les points de données, de préférence une fonction spline, est utilisée dans le calcul de tendance.
7. Procédé selon l'une des revendications 1 à 6, **caractérisé en ce que** la plage de valeurs mesurées (1, 2) est sous-divisée en des sous-plages physiologiquement pertinentes (1.1-1.5, 2.1-2.5).
8. Procédé selon l'une des revendications 1 à 7, **caractérisé en ce qu'**une alarme est émise notamment indépendamment d'une vérification active, à un moment avant qu'une valeur définie et notamment critique du paramètre mesuré soit atteinte.
9. Procédé selon la revendication 8, **caractérisé en ce qu'**une demande d'action corrective est émise à un moment avant qu'une valeur définie et notamment critique du paramètre mesuré soit atteinte.
10. Appareil pour réaliser un procédé selon l'une des revendications 1 à 9, **caractérisé en ce qu'il** comprend :

- a) un appareil de mesure (11) pour mesurer ou fournir continuellement un paramètre qui est mesuré sur ou dans un corps humain, notamment la concentration de glucose ;
- b) une unité de commande système (12) comprenant :
- un ordinateur (14) pour calculer des informations de tendance sur le profil futur escompté du paramètre mesuré et déterminer une valeur de résultat ; et
  - une unité de mémoire (15) pour stocker la sous-division de plage de valeurs mesurées, les paramètres entrés et les valeurs mesurées ; et
- c) un affichage (13) ;
- laquelle unité de commande système (12) est conçue et programmée de sorte que :
- d) la plage de valeurs mesurées (1, 2) de l'appareil de mesure peut être sous-divisée en au moins deux sous-plages (1.1-1.5, 2.1-2.5) ; et laquelle unité de commande système (12) est en outre conçue et programmée de sorte que :
- e) la valeur de résultat puisse être déterminée en fonction d'une valeur courante du paramètre mesuré, des informations de tendance calculées et d'une valeur d'entrée définissable, la valeur de résultat et la valeur d'entrée étant des quantités différentes, la valeur d'entrée définissable étant une sous-plage (2.1-2.5) et la valeur de résultat à déterminer étant une période de temps (4) après laquelle le paramètre mesuré a quitté ou atteint la sous-plage définissable (1.1-1.5 ; 2.1-2.5) ;
- caractérisé en ce que :**
- f) la valeur de résultat déterminée peut être émise via l'affichage (13) ; et
- g) la sous-plage courante (1.2, 1.3), la période de temps écoulée jusqu'à ce que cette sous-plage (4) soit quittée et une sous-plage suivante (2.2, 2.3) qui sera atteinte après avoir quitté la sous-plage courante sont affichées au même moment sur l'affichage (13).
11. Appareil selon la revendication 10, **caractérisé par** un appareil d'entrée (16) assurant l'interaction entre un utilisateur et l'unité de commande système (12).
12. Appareil selon l'une des revendications 10 ou 11, **caractérisé en ce qu'il** comprend également un émetteur d'alarme (17) qui avertit un utilisateur avant qu'une valeur définie et notamment critique du paramètre mesuré soit atteinte.
13. Produit de type programme informatique pour réaliser le procédé selon l'une quelconque des revendications 1 à 9, **caractérisé en ce que :**

- a) des données sont traitées à partir d'une mesure d'un paramètre effectuée continuellement sur ou dans un corps humain, notamment la concentration de glucose ;
- b) une plage de valeurs mesurées (1, 2) du paramètre mesuré est sous-divisée en sous-plages (1.1-1.5 ; 2.1-2.5) ;
- c) des informations de tendance concernant le profil futur escompté du paramètre mesuré sont calculées à partir des données mesurées ;
- d) une valeur de résultat est déterminée en fonction d'une valeur courante du paramètre mesuré, des informations de tendance calculées et d'une valeur d'entrée définissable, la valeur de résultat et la valeur d'entrée étant des quantités différentes, la valeur d'entrée définissable étant une sous-plage (2.1-2.5) et la valeur de résultat à déterminer étant une période de temps (4) après laquelle le paramètre mesuré a quitté ou atteint la sous-plage définissable (1.1-1.5 ; 2.1-2.5) ;
- caractérisé en ce que :**
- e) la sous-plage courante (1.2, 1.3), la période de temps écoulée jusqu'à ce que cette sous-plage (4) soit quittée et une sous-plage suivante (2.2, 2.3) qui sera atteinte après avoir quitté la sous-plage courante sont émises en tant que sortie.



**Fig. 6**



**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- US 2004153257 A1, Munk Jens [0006]
- US 2007128682 A1, Rosman [0007]

专利名称(译)	可视化在人体上测量的参数		
公开(公告)号	<a href="#">EP2166929B1</a>	公开(公告)日	2012-12-19
申请号	EP2008748352	申请日	2008-05-15
[标]申请(专利权)人(译)	罗氏诊断公司		
申请(专利权)人(译)	F.霍夫曼罗氏公司 罗氏诊断有限公司		
当前申请(专利权)人(译)	F.霍夫曼罗氏公司 罗氏诊断有限公司		
[标]发明人	KRIEFTEWIRTH MICHAEL		
发明人	KRIEFTEWIRTH, MICHAEL		
IPC分类号	A61B5/145 G01N27/327 G06F19/00 A61B5/00		
CPC分类号	A61B5/00 A61B5/14532 A61B5/743 G16H15/00		
优先权	2007000966 2007-06-15 CH		
其他公开文献	EP2166929A1		
外部链接	<a href="#">Espacenet</a>		

#### 摘要(译)

在用于在人体上或在人体内连续测量的参数的可视化方法中，特别是葡萄糖浓度，执行以下步骤：首先，测量参数的测量值范围（1,2）是细分为两个或更多子范围（1.1 - 1.5, 2.1 - 2.5）。然后基于两个或更多个测量值计算与测量参数的未来预期曲线有关的趋势信息。基于测量参数的当前值和计算出的趋势信息计算预测测量参数将离开其当前子范围的时间段（4），并且最后显示所确定的时间段（4）。用于执行诸如此类的方法的设备包括测量设备（11），具有计算机（14）的系统控制器（12）以及存储器单元（15）和显示器（13）。同样公开了一种用于在适当的装置上执行诸如此类的方法的计算机程序产品。在计算和显示时间段（4）的基础上，之后测量参数将从一个子范围（1.2）偏离到另一个子范围（2.3），即使没有详细了解，也可以对患者进行评估。医疗关系，他在行动的影响，他可以根据他可获得的预测理解，并在适当时采取纠正措施。