METHOD AND DEVICE FOR ENHANCED DETERMINATION OF PATTERNS IN DATA RELATED TO AT LEAST ONE PHYSIOLOGICAL CONDITION OF A USER

The present specification discloses devices (and corresponding methods and a program product) that assist in determination of a pattern in a data set related to at least one physiological condition of a user, where the devices comprise: a memory comprising a set of data elements, each data element of said set representing a user action and a date and time when said user action was performed, and a processor for graphically displaying a representation of at least a part of said set of data elements being within a predetermined range of dates, wherein the processor is further adapted to graphically animate said representation on said display by dynamically changing said predetermined range of dates. In this way, easier determination of patterns in the data set is obtained since it is enabled how patterns change or evolves over time.
Method and device for enhanced determination of patterns in data related to at least one physiological condition of a user

Field of the Invention:

The present invention relates to the field of self-care of a disease using electronic data analysis devices and methods.

Background of the Invention:

Chronic diseases and other physiological conditions such as diabetes, asthma, hormone therapy, anti-coagulation treatment, or the like, that require effective therapeutic care over long (or even life-long) periods of time have become a widespread phenomenon. Further characteristics of chronic diseases are often that no permanent cure exists and that the involved clinical picture typically is very complex. Typically, such diseases require medication and/or a control of the patient's lifestyle. Other examples of major chronic diseases are rheumatic diseases, and atherosclerotic heart disease.

Diabetes is a classic model disease for chronic diseases and as such the description/examples included is representable for many chronic diseases and as such the invention can readily be transferred from diabetes to many of the chronic diseases.

Diabetes is one such chronic condition of the human body in which lack of insulin raises the blood sugar levels which in turn has harmful effects that sometimes may even endanger the patient's life. A diabetic has to be very careful about the level of blood sugar in his/her body and therefore has to constantly monitor the activities that are likely to have an impact on the same. To keep the blood sugar level in check, a person with diabetes diabetic has to sometimes take insulin. As of now this is generally done by way of insulin injections. These injections have to be administered after considering the patient's present condition as well as carefully predicting the near future state. To this end, various blood sugar measurement devices
such as strips and meters are available in the market. For the ease of operation by the user as well as for portability, the measurement devices have also been combined with insulin administration devices. This way the patient can carry one device that would not only measure his/her disease related parameters but would also assist him/her in administering his/her medicine.

With the advancement in technology, these devices have become even more sophisticated and now incorporate additional functionality such as recording the patient’s disease related data and other useful information. Some of these devices also have communication means that connect them to other computing devices to form a network. The patient, the patient’s doctor and other people can then use the information present on these devices in various ways such as for analysis. International Publication Nos. WO 00/32088, WO 03/005891 and WO 03/015838 all describe such medical devices, networks and method of their operation along with some of the possibilities in the domain. These publications are incorporated herein in entirety by way of reference.

Such devices are great tools for helping a patient to ensure that he or she is in compliance with a medical regimen. The data gathering capabilities of such devices are also a helpful tool for doctors when they are assessing the regimen of a given patient.

One tool to assist in this is the well-known Modal view (also often referred to as Modal day view, basal view, etc.) where important data or parameters are displayed after data collection, search and analysis. More specifically, the Modal view comprises diary data for several days displayed versus the time thus superimposing many days of data into a single picture or image. This allows a user or a doctor to spot patterns in the data where such patterns are representative of habits of a patient/user (forth only denoted user). Such
patterns could e.g. be that just after 9 o'clock in the morning the blood glucose level (referred to as BGL in the following) usually is too high or the like. See e.g. Figure 1 for a graphical presentation of a Modal view. The Modal view can be used to display several types of diary data or parameters of a user like blood glucose measurements and/or administered amount of insulin or medication and/or meal intake and/or alcohol intake and/or physical exercise, etc.

US Patent application 2002/0193679 A1 discloses a method and system using a Modal view, which is incorporated herein in its entirety by reference.

However, due to the large number of data points usually present in the Modal view, i.e. several points for several days plotted along the same time axis of 24 hours in the same picture or frame, it may be very difficult or even impossible to determine any patterns in an efficient way.

Further, since the Modal view comprises data entries for several days typically over a couple of weeks or even months some entries for certain days may obscure or hide patterns for other days. As an example, there generally is a difference in the habits of a user (and thereby a difference in the pattern of the corresponding data entries) during normal working days and the weekend. Due to the presence of entries for normal working days it may be very difficult or even impossible to detect patterns taking place only during weekends. Differences may also occur for days with very high physical activity (e.g. if the user participates in sports or the like) and so on.

In a way, a Modal view comprising enough data points to enable determination of a pattern may be somewhat overloaded with information.
If fewer data entries are included in the Modal view then the problem of not being able to determine any patterns may arise due to the fact that too few entries may be present to ensure that the patterns are detectable.

Additionally, it is also very difficult using prior art techniques to determine patterns (and corresponding habits) from static display.

Further complicating these matters is that Modal views of different users typically are very different as it is not likely that various users will have the same habits.

It is very important to identify sub-optimal or even dangerous patterns/habits of a user so that the patterns/habits can be addressed which ultimately should improve the user’s quality of life.

Therefore there is a need for an improved tool enabling better assistance in determination of patterns in data entries related to at least one physiological condition of a user.

Object and summary of the Invention:

It is an object of the present invention to provide a device (and a corresponding method) for assisting in determination of patterns in a data set related to at least one physiological condition of a user that solves the above-mentioned (and other) shortcomings.

A further object is to provide this in an easy and efficient way.

Yet another object is to provide an improved tool enabling better assistance in determination of patterns in data entries.
These objects, among others, are achieved by a device (and a corresponding method) for assisting in determination of a pattern in a data set related to at least one physiological condition (and e.g. associated co-morbidities) of a user, the device comprising:

- a memory comprising a set of data elements, each data element of said set representing a user action and a date and time when said user action was performed, and
- a processor for graphically displaying a representation of at least a part of said set of data elements on a display, where said part comprises data elements being within a predetermined range of dates, wherein the processor is further adapted to
  - graphically animate said representation on said display by dynamically changing said predetermined range of dates.

In this way, easier determination of patterns in the data set is obtained since it is enabled how patterns change or evolves over time. Also by letting the data be searched for, analysed and presented in a dynamic way enables determination of patterns that are hard to determine using static views.

Such patterns may e.g. arise from behaviour that arises from sub-optimal patient self-management. These patterns are difficult or almost impossible to identify in paper or electronic logbooks or using typical graphical presentations of data related to a physiological condition.

Patterns or habits may comprise the typical time of day of certain actions, such as typical meal times, typical times at which the patient measures a physiological parameter such as the blood glucose level, typical times and doses of medication, etc. Accordingly, the user action may be any action that has influence on the physiological condition(s) to be controlled. Examples of such actions include meal intakes, medication, such as insulin delivery,
measurements of a physiological parameter such as blood glucose level, physical activity, or the like.

Identifying such habits facilitates the user to follow his/her individual habits in a consistent way, thereby allowing a combination of a tight control of the user's lifestyle while providing a high degree of individual freedom and an increased quality of life. In particular, by providing a method that receives user related data (such as blood glucose, insulin intake etc.) as an input and analyses the data to identify user habits and behavior, the self-management of the patient can be customized to the individual patient's lifestyle while still providing control over the patient's day-to-day activities so that his diabetes can be efficiently managed.

It is a further advantage that the observance of the patient's habits and the data recording may be performed by the user himself/herself, thereby increasing the user's independence from health care personnel and, thus, increasing the user's quality of life. Furthermore, the monitoring and data recording by the user increases the possibility of constant observance, thereby improving the quality of the recorded data.

The user may be the patient, a health care professional or the like.

According to one embodiment, the change of said predetermined range is done based on input obtained from a user.

According to one embodiment, the change of said predetermined range of dates comprises:
   - starting from a predetermined range of dates and then gradually increasing the range of dates.
According to one embodiment, the change of said predetermined range of dates comprises:
- starting from a predetermined range of dates and then gradually decreasing the range of dates.

According to one embodiment, the change of said predetermined range of dates comprises:
- starting from a predetermined range of dates and then gradually moving the range of dates.

According to one embodiment, the user action comprises one or more selected actions from the group of a blood glucose measurement, a measurement of a body parameter from blood, urine and/or the like, a meal intake, alcohol intake, physical exercise, and administering medication.

The body parameter from blood, urine and/or the like may e.g. be blood glucose, ketones, urine glucose, proteins, lipids, etc. In the following blood glucose is used as an example.

According to one embodiment, the representation of at least a part of said set of data elements is a Modal view representation.

According to one embodiment, the at least one physiological condition comprises a chronic disease.

According to one embodiment, the at least one physiological condition comprises diabetes.

According to one embodiment, the representation further comprises a calculated mean value and standard deviation bars for each data element.
According to one embodiment, the representation comprises data elements for weekdays that have been designated in response to input from a user.

According to one embodiment, the representation comprises a part for each weekday where data elements belonging to a specific weekday is displayed at the corresponding part.

According to one embodiment, the device is selected from a group of:
- a personal digital assistant (PDA),
- a mobile phone,
- a personal computer (PC),
- a laptop,
- a medical device,
- a blood measuring device,
- a blood glucose device,
- a medication administration device,
- an insulin delivery device, and
- combinations thereof.

The term device may comprise any electronic equipment, such as a suitably programmed programmable device. The device may e.g. be a portable or wearable device that can be carried by the user or a stationary pc or the like. For example, the device may be a suitably programmed portable computer, such as a handheld computer, a PDA, or the like. In other embodiments, the device is a suitably programmed mobile telephone, pager, or other mobile communications device.

In some embodiments, the device is a drug administration device, such as an insulin administration device, e.g. an insulin injection device, an insulin inhalator, or the like. Furthermore, the drug deliveries by such a combined device may be recorded directly by the device, thereby allowing the recording
of the data without the need for an active user input or data transmission from another device. For example, a drug administration device may be capable of storing patient related data such as drug dosage, meal details, blood glucose level etc.

In other embodiments, the device is an insulin measuring device, thereby combining insulin measurements with a reminder system. Consequently, the number of separate devices to be carried by a user is reduced, and the times of day at which the blood glucose is measured may be directly fed into the habit analysis system, thereby reducing the required manual inputs or data transmissions from other devices.

According to one embodiment, the device further comprises means

- for printing out a copy of said representation,
- for speaking out said representation, and/or
- for presenting or displaying said representation in other ways

Speaking could e.g. comprise the speaking of “I have identified the following pattern, which is important...” or the like.

The present invention relates to different aspects including the devices described above and in the following, methods, and computer programs, each yielding one or more of the benefits and advantages described in connection with the above-mentioned devices, and each having one or more embodiments corresponding to the embodiments described in connection with the above-mentioned devices.

More specifically, the invention also relates to a method of assisting in determination of a pattern in a data set related to at least one physiological condition of a user, where a set of data elements are stored in a memory and where each data element of said set represents a user action and a date and
time when said user action were performed, the method comprising the steps of:

- graphically displaying a representation of at least a part of said set of data elements on a display, where said part comprises data elements being within a predetermined range of dates, and
- graphically animating said representation on said display by dynamically changing said predetermined range of dates.

Advantageous embodiments of the method according to the present invention are defined in the sub-claims and described in detail in the following. The embodiments of the system correspond to the embodiments of the method and have the same advantages for the same reasons.

Further, the invention also relates to a computer readable medium/ a computer program product having stored thereon instructions for causing one or more processing units to execute the method according to the present invention.

**Brief Description of the Drawings:**

These and other aspects of the invention will be apparent from and elucidated with reference to the illustrative embodiments shown in the drawing, in which:

Figure 1 illustrates a graphical representation of a prior art Modal view;

Figure 2a illustrates a graphical representation of a graphical user interface comprising physiological-related data entries/elements according to one embodiment of the present invention;

Figure 2b illustrates the graphical representation of Figure 2a at a later stage;
Figure 3a illustrates a graphical representation of a graphical user interface comprising physiological-related data entries/elements according to another embodiment of the present invention;

Figure 3b illustrates the graphical representation of Figure 3a at a later stage;

Figure 4a illustrates a graphical representation of a graphical user interface comprising physiological-related data entries/elements according to yet another embodiment of the present invention;

Figure 4b illustrates the graphical representation of Figure 4a at a later stage;

Figure 5 illustrates a schematic block diagram of an embodiment of a device according to the present invention;

Figure 6 illustrates a schematic block diagram of an embodiment of a system according to the present invention;

Figure 7a illustrates another embodiment of the present invention;

Figure 7b illustrates a further embodiment of the present invention; and

Figure 7c illustrates yet a further embodiment of the present invention.

**Detailed Description of the Drawings:**
The inventive concept as disclosed herein is useful in any of the diseases or other physiological conditions that require a constant monitoring of the lifestyle of the patient. In the following, the invention will be described in the context of the self-management of diabetes, in particular the self-management of insulin delivery and blood glucose measuring by the patient.
Figure 1 illustrates a graphical representation of a prior art Modal view. Shown is a graphical user interface (GUI) (100) containing a Modal view comprising various blood glucose measurements (101). Further comprised are various amounts of insulin (102) that the user has administered. The part comprising blood glucose measurements (101) has in this embodiment a graphical indication of a preferred or target boundary (103) for blood glucose. Optimally, the user should have his or hers blood glucose level (BGL) within this boundary.

As can be seen the medical-related data for several days is plotted versus the time of the day that they were obtained, where the time scale spans 24 hours. This helps in identifying possible data patterns (and corresponding habits). The data (both BGL and administered insulin) is plotted as a data pair or element comprising the time that the measurement was obtained and the value of the measurement (e.g. mmol/L for BGL; IU for insulin). The date of the measurement is typically also stored (although not explicitly shown).

Such a GUI is useful in assisting a user (e.g. a patient, a health-care professional, a physician, a nurse, etc.) in determining any patterns and in particular non-optimal patterns. As can be seen in this specific example, it appears that the user, that this data is for, is a user that quite consistently administers insulin at about 8 o’clock (104) in the morning, which is probably before breakfast. Further, it can be seen that this user has quite a lot of BGL values that are too high (e.g. above 12 mmol/L), which signals that there are some habits of the user that should be improved upon.

The GUI part comprising insulin data (102) may comprise data for different types of insulin (e.g. slow acting and fast acting insulin). The different types may as an example be color-coded and/or be indicated by different types of symbols (e.g. '"', '•', 'Δ', etc.). BGL data (101) may also be indicated using color codes and/or various symbols.
Other types of data like exercise, amount of intake of food or alcohol or the like could also be included and presented in the GUI (100).

The GUI (100) preferably also comprises various other elements such as descriptive fields comprising relevant information.

Figure 2a illustrates a graphical representation of a graphical user interface comprising physiological-related data entries or elements according to one embodiment of the present invention.

Shown is a graphical user interface (GUI) (100) where a number of data elements related to at least one physiological condition of a user is displayed where the GUI corresponds to the one shown and explained in connection with Figure 1 except as explained in the following.

According to the present invention data elements being within a predetermined range of dates are being displayed. The range of dates may be selected by the user using traditional ways such as typing, clicking, using drop-down menus, calendar functionality, etc. The user may specify a start date and an end date or a length of the date range/data window. According to this embodiment of the present invention the range of the displayed data elements is animated on the display by gradually increasing the range of dates. The animation may e.g. step one day at a time, less than one day or several days if preferred.

The increasing range view increase the number of days that data is displayed by starting at a selected start day (e.g. 1st July) or a selected number of start days (e.g. all days of July) and continually adding data for days until a target date is met or the user stops or pauses the animation.
The first view, picture, image, frame or the like would then contain the data of
the start day (or start days) and would then be updated with the data from the
2. day, the 3. day and so on until the target date is reached and would now
be showing data from the entire selected date range. In effect the time
5 window of the displayed data elements is gradually increased.

The target date could e.g. be specified as an end date (e.g. 2nd August
2004), as a length in days (e.g. 60 days from the start day(s)). The user could
10 also slide back and forth between the date ranges, e.g. using a time slider
(105) or the like.

This may greatly facilitate recognizing different types of patterns in the
displayed data such as measured blood glucose, administered/injected
amount of insulin or other types of medication, exercise, meal intake, etc.

15 In a preferred embodiment, when a single data point (e.g. BGL, insulin or
both types) is selected by an appropriate user input device then a line is
drawn between the various data points of a single day that the selected point
belongs to. This helps illustrating which data arises from a single day, which
20 could be useful for disregarding a single bad day (it is important to
understand whether several BGL values that is too large is for the same day
or whether they are for several days, which could indicate a pattern that
needs to be addressed. This also holds for the embodiments described later.

25 It should be understood that the GUI (100) could comprise only one of the
BGL data (101) or the insulin data (102) (or the other types of data) just as
well as both of them at the same time.

Figure 2b illustrates the graphical representation of Figure 2a at a later stage.
30 This figure corresponds to the one of Figure 2a but at a later stage where the
range according to the present invention has increased, which is also apparent from the time slider (105).

As can be seen additional data elements is being shown. Preferably, several frames have been displayed between the stage of Figure 2a and the stage of Figure 2b.

Figure 3a illustrates a graphical representation of a graphical user interface comprising physiological-related data entries/elements according to another embodiment of the present invention.

This embodiment of the present invention corresponds to the embodiment of Figures 2a and 2b with the exception that instead of an increasing range a decreasing range is displayed/animated and that whereas the embodiment of Figures 2a and 2b would typically start with data for a single day or several days but would add days then this embodiment would typically start with data for several days where data would gradually be removed.

According to this embodiment of the present invention the range of the displayed data elements is animated on the display by gradually decreasing the range of dates. The animation may e.g. step one day at a time, less than one day or several days if preferred.

The decreasing range view decrease the number of days that data is displayed for, starting at a selected number of start days (e.g. 1. of July to 1. of December) and continually removing data for days until a target date (e.g. 1. of July) is met or the user stops or pauses the animation. In effect, the time window of the displayed data is gradually decreased.

The first view, picture, image, frame or the like would then contain the data of the start days and would then be updated to not have the data from the last
day of the range, not having the data for the two last days of the range, not having the data for the last three days and so on until the target date is reached and would now only be showing data from the first day of the range or from several days in the beginning of the selected date range.

This may greatly facilitate recognizing different types of patterns in the displayed data such as measured blood glucose, administered/injected amount of insulin or other types of medication, meal intake, etc.

Figure 3b illustrates the graphical representation of Figure 3a at a later stage. This figure corresponds to the one of Figure 3a but at a later stage where the range according to the present invention has decreased.

As can be seen fewer data elements is being shown. Preferably, several frames have been displayed between the stage of Figure 3a and the stage of Figure 3b.

Figure 4a illustrates a graphical representation of a graphical user interface comprising physiological-related data entries/elements according to yet another embodiment of the present invention.

This embodiment of the present invention corresponds to the embodiments of Figures 2a and 2b and Figures 3a and 3b with the exception that instead of having an increasing or decreasing time window then the time windows is shifted while keeping its length. The animation may e.g. step one day at a time, less than one day or several days if preferred.

This embodiment animates a view of a given length (e.g. 1 month) from a selected start date to a selected end day (or the other way around). First data from a first period (e.g. 1 month) is being displayed. Then the time window is moved along e.g. in steps of 1 day to the end date where the data of the last
month will be displayed (if the moving time window is 1 month). The time window may be moved in both directions.

Figure 4b illustrates the graphical representation of Figure 4a at a later stage. As can be seen the time window has moved and different data is being displayed. Preferably, several frames have been displayed between the stage of Figure 4a and the stage of Figure 4b.

It is to be understood that one tool could comprises all or just some of the animations of the embodiments of Figures 2a – 4b and could also comprise the embodiments or the functionality of Figures 7a – 7c.

Figure 5 illustrates a schematic block diagram of an embodiment of a device according to the present invention.

The device, generally designated 301, comprises a data input unit 302, a processing unit 303 configured to receive the data input via input unit 302, a memory 304 or other storage device connected to the processing unit 303, and an output unit 305 connected to the processing unit 302.

In some embodiments, the data input unit 302 comprises user input means such as push buttons, a keypad, a keyboard, a touch screen, a pointing device, e.g. a computer mouse, a stylus, a mouse pad, or the like, allowing a user to enter data, in particular the data to be recorded for the purpose of the habit detection. The input unit further allows the user to select or specify data ranges, start and end dates, etc. Alternatively or additionally, the input unit 302 may comprise different input means such as a data interface adapted to receive data from other devices, e.g. from a blood glucose measuring device, an insulin administration device, from a data processing device, or the like.

The data interface may comprise any circuit or device suitable for data communication via a wired or a wireless channel. Examples of data
interfaces include but are not limited to an infrared port, e.g. an IrDa port, a radio-frequency interface such as Bluetooth, a serial port, such as USB, FireWire, or the like. Alternatively or additionally, the input unit 302 may comprise an internal interface for receiving data from other components within the device 301, e.g. in an embodiment, where the device 301 comprises both a diabetes self-management device and a blood glucose measuring device and/or an insulin administration device.

The processing unit 303 may comprise a suitably programmed microprocessor or any other suitable processing means, such as Digital Signal Processors (DSP), Application Specific Integrated Circuits (ASIC), Programmable Logic Arrays (PLA), Field Programmable Gate Arrays (FPGA), special purpose electronic circuits, etc., or a combination thereof.

The memory 304 may be any suitable type of memory or storage device, such as a non-volatile memory, e.g. flash memory, EPROM, EEPROM, a hard disk, or the like.

The output unit 305 includes any suitable circuit or device for issuing a reminder, e.g. an audible reminder, such as a beep or other sound, a visual reminder, and/or a tactile reminder. Hence, the output unit may comprise a sound generator, a loudspeaker, an LED or other light source, a display such as and LCD display, a vibrator, etc., or any combination of the above.

The output unit includes a display that provides a graphical user interface (GUI) for presenting feedback, data elements, etc. to the user and allowing the user to edit them as described herein.

The device described herein may be a special-purpose device or a combined device providing functionality as described herein in combination with an insulin administration device, a blood glucose measurement device or any
other device used by a diabetes patient. In some embodiments, the device may be embodied as a suitably programmed general-purpose data processing device, such as a handheld computer, a PDA, or the like, or a suitably configured/programmed personal communications device, such as a mobile telephone, or the like.

The process described herein may be implemented by a single device as described above or by a system comprising more than one device. In particular, the data animation can either be performed on the machine on which the data was entered, or the data can be transferred onto a general purpose computing device that can then perform the said functions.

The link up of these user device to another computing device such as a desktop, laptop, PDAs etc., allows an improved analysis of the data using the enhanced computational power available as well as sophisticated and specialized software designed for the purpose. Various statistical means may be employed to display the patient data for easy understanding as well as accurate and beneficial analysis. For instance, there can be a report which would show the patient’s blood glucose level at various times of the day and indicate any undesired highs or lows. Similarly there can be a report for patient’s food intake. These reports can be textual or various graphical representations such as bar graph, pie chart, histograms etc can be used to facilitate easier understanding of the results.

Modal day display is one such kind of display in which patient related events that occurred on different days are treated as if they occurred on a single day, thereby providing a compact overview of the patient’s daily habitual patterns. Algorithms such as the 7 point algorithm for measuring blood glucose may be used for such display. In this algorithm the display is before and after each main meal i.e. breakfast, lunch and dinner and at sleep time.
Figure 6 illustrates a schematic block diagram of an embodiment of a system according to the present invention.

The system comprises a device, e.g. a suitably configured drug administration device, generally designated 401, comprising an input unit 402, a processing unit 403, a memory 404, and an output unit. The device 401 and the above-mentioned components correspond to the device 301 and its corresponding components described in connection with Figure 5 and will therefore not be described again here.

The device 401 further comprises an interface unit 406 adapted to communicate data with an external data processing system 410. To this end, the data processing system 410 comprises a corresponding interface unit 412. Each of the interface units 406 and 410 may include any suitable circuit or device adapted to provide data communication between the device 401 and the data processing system 410. Examples of interface units include but are not limited to an infrared port, e.g. an IrDa port, a radio-frequency interface such as Bluetooth, a serial port, such as USB, FireWire, or the like, a local area network (LAN) connection, a wireless local area network (WLAN) connection, an ADSL connection, an ISDN connection or any other Internet connection, a data connection via a cellular telecommunications network, e.g. via GSM, GPRS, UMTS, or the like. In yet alternative embodiments, data may transferred between the device 401 and the data processing system 410 by means of a data carrier, such as a memory stick, a diskette, a smart card, or the like.

The data processing system 410 further comprises a processing unit 413, a memory or other storage device 414, e.g. as described in connection with the processing unit 303 and the memory 304. Furthermore, the data processing system 410 provides a graphical user interface 416, e.g. via a suitable display and a corresponding input device, such as a keyboard, keypad,
pointing device, etc. For example, the data processing system 410 may be a suitably programmed conventional computer, e.g. a desktop personal computer (PC), a portable computer, or the like.

Hence, in the embodiment of Figure 6, the data entry may be performed via the user device 401 and/or the data processing system 410.

This arrangement between the device and the data processing system may be a simple one-to-one link between the two entities. However, they may also be part of a patient-doctor-relative-peer network. For example the data processing system may periodically logon to a Local Area Network or Internet, or the like, to transmit the user readings to a remote database server that might be used to generate reports from a different computing system such as that of a doctor, relative of the patient and the like. These computing devices can be general-purpose desktops or other variations such as laptop, cell phones, PDAs etc.

Figure 7a illustrates another embodiment of the present invention. Shown is a GUI (100) where the graphical representation or animation further comprises a calculated mean value and standard deviation bars for each data element in addition to the data shown in Figures 2a – 4b.

This additional information may be useful when determining patterns.

Figure 7b illustrates a further embodiment of the present invention. Shown is a GUI (100) where the graphical representation or animation further comprises data elements for weekdays that have been designated in response to input from a user, i.e. a user selects which weekdays (e.g. Mondays and Saturdays) within the range of dates that data is to be displayed for.
This additional information may be useful when determining patterns. For example, if the user usually perform sports on Mondays and Saturdays this filter is very helpful. Other examples could e.g. be to determine patterns for Fridays and Saturdays where some users may have a different intake of food and/or alcohol.

Figure 7c illustrates yet a further embodiment of the present invention. Shown is a GUI (100) where the representation or animation further comprises a specific part for each weekday where data elements belonging to a specific weekday is displayed at the corresponding part.

This additional information may be useful when determining patterns. Especially if the user’s patterns or habits is dependent on the specific day, e.g. due to physical exercise, intake of alcohol, etc.

Although some embodiments have been described and shown in detail and using diabetes as a central theme, the invention is not restricted to them, but may also be embodied in other ways within the scope of the subject matter defined in the following claims. The invention may also be applied to other similar applications including but not restricted to general health monitoring.

The method, product means, and device described herein can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed microprocessor. In particular, the features of the method described herein may be implemented in software and carried out on a data processing device or other processing means caused by the execution of program code means such as computer-executable instructions.

The executing steps can be realized in a centralized fashion in one computer system, or in a distributed fashion where different elements are spread
across several interconnected computer systems. Computer program means or computer program in the present context mean any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation or b) reproduction in a different material form.

In some instances, the program may be supplied to the user encoded on a CD-ROM or a floppy disk (both generally depicted by the storage device), or alternatively could be read by the user from the network via a modem device connected to the computer. Still further, the computer system can load the software from other computer readable media. This may include magnetic tape, a ROM or integrated circuit, a magneto-optical disk, a radio or infra-red transmission channel between the computer and another device, a computer readable card such as a PCMCIA card, and the Internet and Intranets including email transmissions and information recorded on Internet sites and the like. The foregoing are merely examples of relevant computer readable media. Other computer readable media may be practiced without departing from the scope and spirit of the invention.

In the device claims enumerating several means, several of these means can be embodied by one and the same item of hardware, e.g. a suitably programmed microprocessor, one or more digital signal processor, or the like. The mere fact that certain measures are recited in mutually different dependent claims or described in different embodiments does not indicate that a combination of these measures cannot be used to advantage.

In the claims, any reference signs placed between parentheses shall not be constructed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word
"a" or "an" preceding an element does not exclude the presence of a plurality of such elements.
Patent claims:

1. A device for assisting in determination of a pattern in a data set related to at least one physiological condition of a user, the device comprising:
   - a memory comprising a set of data elements, each data element of said set representing a user action and a date and time when said user action was performed, and
   - a processor for graphically displaying a representation of at least a part of said set of data elements on a display, where said part comprises data elements being within a predetermined range of dates, wherein the processor is further adapted to
     - graphically animate said representation on said display by dynamically changing said predetermined range of dates.

2. A device according to claim 1, wherein said change of said predetermined range is done based on input obtained from a user.

3. A device according to claims 1 – 2, wherein said change of said predetermined range of dates comprises:
   - starting from a predetermined range of dates and then gradually increasing the range of dates.

4. A device according to claims 1 – 2, wherein said change of said predetermined range of dates comprises:
   - starting from a predetermined range of dates and then gradually decreasing the range of dates.

5. A device according to claims 1 – 2, wherein said change of said predetermined range of dates comprises:
starting from a predetermined range of dates and then gradually moving the range of dates.

6. A device according to claims 1 – 5, wherein the user action comprises one or more selected actions from the group of a blood glucose measurement, a measurement of a body parameter from blood, urine and/or the like, a meal intake, alcohol intake, physical exercise, and administering medication.

7. A device according to any one of claims 1 – 6, wherein said representation of at least a part of said set of data elements is a Modal view representation.

8. A device according to any one of claims 1 – 7, wherein the at least one physiological condition comprises a chronic disease.

9. A device according to any one of claims 1 – 7, wherein the at least one physiological condition comprises diabetes.

10. A device according to any one of claims 1 – 9, wherein said representation further comprises a calculated mean value and standard deviation bars for each data element.

11. A device according to any one of claims 1 – 10, wherein said representation comprises data elements for weekdays that have been designated in response to input from a user.

12. A device according to any one of claims 1 – 11, wherein said representation comprises a part for each weekday where data elements belonging to a specific weekday is displayed at the corresponding part.

13. A device according to any one of claims 1 - 12, wherein said device is selected from a group of:
- a personal digital assistant (PDA),
- a mobile phone,
- a personal computer (PC),
- a laptop,
- a medical device,
- a blood measuring device,
- a blood glucose device,
- a medication administration device,
- an insulin delivery device, and
- combinations thereof.

14. A device according to any one of claims 1 – 13, wherein the device further comprises means:
- for printing out a copy of said representation,
- for speaking out said representation, and/or
- for presenting or displaying said representation in other ways

15. A method of assisting in determination of a pattern in a data set related to at least one physiological condition of a user, where a set of data elements are stored in a memory and where each data element of said set represents a user action and a date and time when said user action was performed, the method comprising the steps of:
- graphically displaying a representation of at least a part of said set of data elements on a display, where said part comprises data elements being within a predetermined range of dates, and
- graphically animating said representation on said display by dynamically changing said predetermined range of dates.

16. A method according to claim 15, wherein said change of said predetermined range is done based on input obtained from a user.
17. A method according to claims 15 – 16, wherein said change of said predetermined range of dates comprises:
   – starting from a predetermined range of dates and then gradually increasing the range of dates.

18. A method according to claims 15 – 17, wherein said change of said predetermined range of dates comprises:
   – starting from a predetermined range of dates and then gradually decreasing the range of dates.

19. A method according to claims 15 – 17, wherein said change of said predetermined range of dates comprises:
   – starting from a predetermined range of dates and then gradually moving the range of dates.

20. A method according to claims 15 – 19, wherein the user action comprises one or more selected actions from the group of a blood glucose measurement, a measurement of a body parameter from blood, urine and/or the like, a meal intake, alcohol intake, physical exercise, and administering medication.

21. A method according to any one of claims 15 – 20, wherein said representation of at least a part of said set of data elements is a Modal view representation.

22. A method according to any one of claims 15 – 21, wherein the at least one physiological condition comprises a chronic disease.

23. A method according to any one of claims 15 – 21, wherein the at least one physiological condition comprises diabetes.
24. A method according to any one of claims 15 – 23, wherein said representation further comprises a calculated mean value and standard deviation bars for each data element.

25. A method according to any one of claims 15 – 24, wherein said representation comprises data elements for weekdays that have been designated in response to input from a user.

26. A method according to any one of claims 15 – 25, wherein said representation comprises a part for each weekday where data elements belonging to a specific weekday is displayed at the corresponding part.

27. A method according to any one of claims 15 – 26, wherein said method is used in a device selected from a group of:
   - a personal digital assistant (PDA),
   - a mobile phone,
   - a personal computer (PC),
   - a laptop,
   - a medical device,
   - a blood measuring device,
   - a blood glucose device,
   - a medication administration device,
   - an insulin delivery device, and
   - combinations thereof.

28. A method according to any one of claims 15 - 27, where the method further comprises the step(s) of:
   - printing out a copy of said representation,
   - speaking out said representation, and/or
– presenting or displaying said representation in other ways

29. A computer program product comprising program code means adapted to cause, when loaded into a data processing device, the data processing device to perform the method according to any one of claims 15 – 28.
Figure 7c
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
A61B5/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B G06F

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>WO 01/93756 A (NEXAN LIMITED; FERGUSON, PETER; KUMAR, HARPAL; LAY, GRAHAM; LLEWELLYN,) 13 December 2001 (2001-12-13) page 2, paragraph 2 page 6, paragraph 2 page 7, paragraph 3 page 12, paragraph 2 page 19, last paragraph - page 20, paragraph 1 page 20, last paragraph page 35, paragraph 1 - page 36, paragraph 3 page 39, paragraph 5 - page 42, paragraph 5 figures 1,11A,-12 -----</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:
*A* document defining the general state of the art which is not considered to be of particular relevance
*E* earlier document but published on or after the international filing date
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
*C* document referring to an oral disclosure, use, exhibition or other means
*P* document published prior to the international filing date but later than the priority date claimed

** Later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
**X** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
**Y** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
**&** document member of the same patent family

Date of the actual completion of the international search
17 March 2006

Date of mailing of the international search report
29/03/2006

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