CLAIMS

1. A device (1) for non-invasive blood glucose level estimation, comprising:

- a measuring unit (2), comprising the following modules:

- a measuring module (4) for measuring the glucose level, comprising a plurality of elements configured to perform a process for non-invasive blood glucose level measurement;

- a first computer module (5), configured to control the measuring module (4), and to process data on a first part of the process for measuring the blood glucose level, starting from the data provided by the measuring module (4);

- a first communications module (6), configured to receive configuration commands and send the data associated with such commands to the first computer module (5);

- a first data storage module (7), configured to store the information from the measuring unit (2);

- a pushbutton (8), configured for activating the measuring unit (2);

- a personal monitoring unit (3), physically separated from the measuring unit (2), comprising:

- a second communications module (17) intended to establish bidirectional wireless communications with at least the measuring unit (2);

- a second computer module (18), configured to process data on a second part of the process for measuring the blood glucose level;

- an interface module (19), configured to display the information from the measuring unit (2) and the data provided by the second computer module (18), and to enable the user to interact;

- a third communications module (20), configured to establish bidirectional wireless communications with an external service provider (21);

- a second data storage module (22), configured to store data from the personal monitoring unit (3);

and ~~characterised in that~~wherein the measuring module (4) comprises:

- a first light emitter E1 (9), activatable from the first computer module (5), ~~and configured to emit with a wavelength corresponding to a maximum absorbance in the absorption spectrum of the glucose molecule within the near-infrared range,~~ which strikes on the skin of a body area (10) irrigated by a vascular bed;

- a second E2 light emitter (11), activatable from the first computer module (5),

~~and configured to emit with a wavelength corresponding to a minimum absorbance in the absorption spectrum of the glucose molecule,~~ and arranged close to the light emitter E1 (9);

- ~~a~~ one photodetector (12), sensitive to the wavelength of the first and second light emitters E1 and E2 (9, 11), configured to generate an electric current signal (S1), the amplitude of which depends on the intensity of light received in the sensitivity spectrum of the photodetector (12);

- a first signal amplifier (13), which generates an electrical voltage signal (S2), amplified from the electrical current signal (S1), when said electrical current signal (S1) is weak;

- a first high-pass filter (14) ~~with a cut-off frequency which enables the pulsating components related to cardiac activity to pass, such that it abstracts the components of the electrical voltage signal (S2) which vary due to the arterial flow~~, generating a third signal (S3);

- a second signal amplifier (15), which generates an amplified signal (S4) from the third signal (S3);

- a second low-pass filter (16) ~~with a cut-off frequency which does not enable the pulsating components related to cardiac activity to pass, such that it abstracts the components of the electrical voltage signal (S2) related to stationary properties in the measurement and low-frequency noise~~, generating a fifth signal (S5); ~~.~~

and ~~also~~ characterised in that: the first light emitter E1 is configured to emit with a wavelength corresponding to a maximum absorbance in the absorption spectrum of the glucose molecule within the near-infrared range, the second light emitter E2 is configured to emit with a wavelength corresponding to a minimum absorbance in the absorption spectrum of the glucose molecule, the first and second light emitters E1 and E2 (9, 11) are arranged such that the light beams cross through a relatively translucent body area (10), such as a finger or an ear lobe, and are captured by the photodetector (12) located on the opposite side of the body area wherein the emitters (10) are located; the photodetector is sensitive to the wavelength of the first and second light emitters E1 and E2 (9, 11); the first high-pass filter (14) has a cut-off frequency which enables the pulsating components related to cardiac activity to pass, such that it abstracts the components of the electrical voltage signal (S2) which vary due to the arterial flow; and the second low-pass filter (16) has a cut-off frequency which does not enable the pulsating components related to cardiac activity to pass, such that it

abstracts the components of the electrical voltage signal (S2) related to stationary properties in the measurement and low-frequency noise.

2. A method for non-invasive blood glucose level estimation using the device described in claim 1, performed in a distributed manner by the first computer module (5) and the second computer module (18), and comprising the following operations:

- performing a first estimation (28) of a first parameter (D1) as the average value of the fifth signal (S5) during a pre-configured time period P1 (25) wherein the light emitters E1 (9) and E2 (11) are deactivated;
- performing a second estimation (29) of a second parameter (D2) as the average value of the fifth signal (S5) during a second pre-configured time period P2 (26) wherein the emitter E1 (9) is activated, and the emitter E2 (11) is deactivated;
- performing a third estimation (30) of a third parameter (D3) during that second pre-configured time period P2 (26), wherein the third parameter corresponds to the average value of the differences between successive maxima and minima identified in the pulsating signal (S4);
- performing a fourth estimation (31) of a fourth parameter (D4) as the average value of the fifth signal (S5) during a third pre-configured time period P3 (27) wherein the emitter E2 (11) is activated, and the emitter E1 (9) is deactivated;
- performing a fifth estimation (32) of a fifth parameter (D5) during the third pre-configured time period P3 (27), wherein said fifth parameter (D5) corresponds to the average value of the differences between successive maxima and minima identified in the pulsating signal (S4);
- estimating the blood glucose level (33) starting from a model which depends on the parameters from the first to the fifth (D1, D2, D3, D4, D5) wherein the model weights the dependence with respect to these parameters (D1, D2, D3, D4, D5), thus isolating the influence of glucose according to two conditions: with the glucose molecules subjected to a light associated with a maximum absorbance in the second parameter (D2) and third parameter (D3) or subjected to a light associated with a minimum absorbance in the fourth parameter (D4) and the fifth parameter (D5) and wherein the influence of the ambient light in the measurement

of the photodetector (12) is weighted in the dependence with respect to the first parameter (D1), and wherein the influence of the signal components related to stationary properties in the measurement and low-frequency noise is weighted in the dependence with respect to the second and fourth parameters (D2, D4), and the model weights the dependence with respect to the third and fifth parameters (D3, D5), in order to isolate the influence of the arterial blood in the estimation, and eliminate the influence of other tissues.

3. The method of claim 2 wherein the dependence of the model for glucose level estimation with respect to the first to fifth parameters (D1, D2, D3, D4, D5) is performed based on coefficients which can be configured remotely by means of sending commands, and wherein the values of the coefficients generate a generalised model for use in different users, or a customised model for an individual use, or a generalised and customisable model including the dependency with other parameters related to the particular characteristics of the user.

4. The method of claim 2 incorporating an operation which activates an alarm locally and remotely when the glucose estimation records a value considered unsuitable.

5. The method according to any of claims 2 to 4, wherein the automatic estimation of the blood glucose level is performed in pre-configured time instants according to a pre-established plan.