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Amended claims in accordance with Rule 137(2) EPC.

(54) **MONITORING SANITARY MIRROR DEVICE**

(57) The present invention relates to a sanitary mirror device (1), comprising:
- a mirror element (2) having a reflective mirror plane;
- a sensor unit (4) including one or more sensors (41, 42, 43, 44) which are configured to detect body characteristics data in a contactless manner, the body characteristics data corresponding to or related to at least one body characteristics of an individual in front of the mirror device (1);
- a display unit (3);
- a control unit (5) configured to receive the body characteristics data and to instruct the display unit (3) to display information corresponding to and/or relating to the body characteristics data.

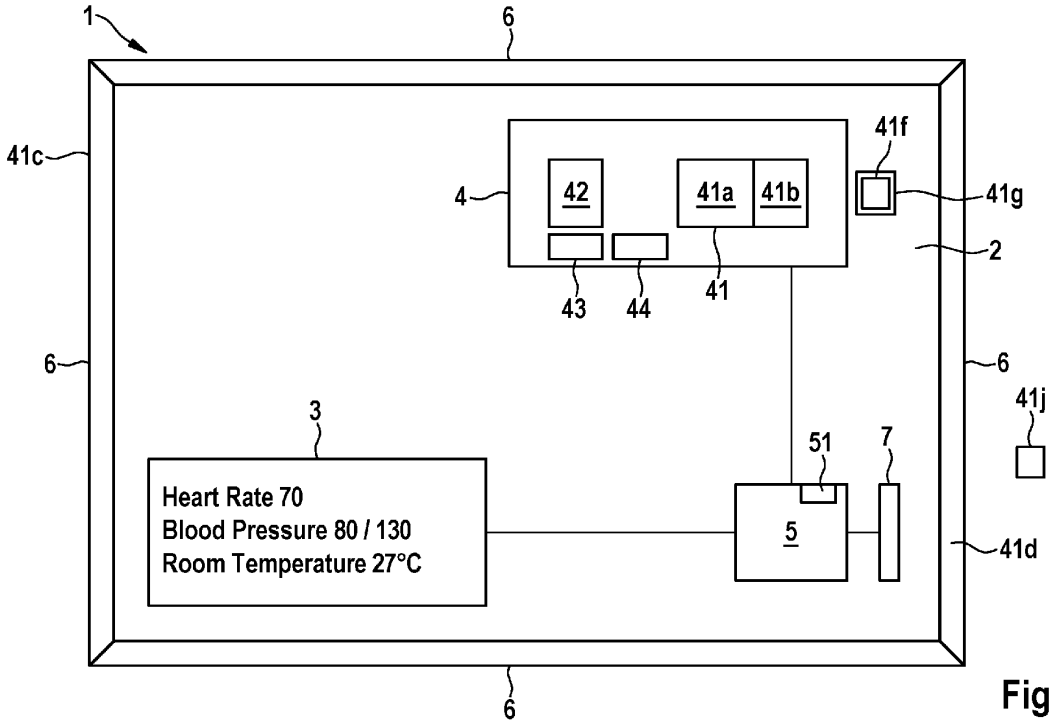

Fig. 1

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Description

Technical Field

[0001] The present invention relates to sanitary mirrors, particularly sanitary mirror devices capable of monitoring body characteristics.

Technical Background

[0002] In bathrooms and other sanitary facilities, mirrors are common which help individuals to check their outer appearance before leaving the bathroom or the sanitary facility. As such mirrors are often installed above a faucet, it belongs to a morning routine of most people to stand in front of the mirror brushing their teeth, washing their face, applying cosmetics, styling hair, and the like.

[0003] Often, it also belongs to a morning routine to use a body scale to measure the body weight, using other separate devices measuring the heart rate and/or blood pressure and/or to make measurements of other body characteristics such as respiratory rate or body temperature.

[0004] Particularly for sportive individuals, body characteristics, such as blood pressure and heart rate, are of permanent continuous interest and are usually measured in the mornings shortly after getting up from the night rest.

[0005] So the morning routine usually takes a significant part of the day. Particularly, the additional actions of measuring body characteristics prolong the morning routine. As time is often critical in the mornings these additional actions require getting up earlier.

[0006] It is an object of the present invention to improve the morning routine by automatizing the single actions of measuring and monitoring the current body characteristics.

Summary of the Invention

[0007] This object is achieved by the sanitary mirror device for monitoring body characteristics according to claim 1.

[0008] Further embodiments are indicated in the depending sub-claims.

[0009] According to a first aspect a sanitary mirror device is provided, comprising:

- a mirror element having a reflective mirror plane;
- a sensor unit including one or more sensors which are configured to detect body characteristics data in a contactless manner, the body characteristics data corresponding to or related to at least one body characteristics of an individual in front of the mirror device;
- a display unit;
- a control unit configured to receive the body characteristics data and to instruct the display unit to display information corresponding to and/or relating to the body characteristics data.

[0010] In contrast to the common passive sanitary mirrors, the sanitary mirror device according to the present invention further includes a sensor unit configured to obtain a body characteristic of an individual which is presently located (standing, sitting) in front of the mirror element. By means of the display unit whose display area is embedded or abuts to the mirror plane of the mirror element, the measured body characteristics or related information can be displayed and presented to the individual.

[0011] This allows the individual using the sanitary mirror device to do the morning routine as usual while at the same time being informed about the personal body characteristics which have been measured and obtained during the time period the individual has been present in front of the mirror device. This allows to save precious morning time as the additional actions to do measurements and to get informed about body characteristics can be reduced.

[0012] The display unit may be integrated with the mirror element so that a display area of the display unit is embedded or directly abuts to the mirror plane.

[0013] Particularly, the display area may be formed as a semi-transparent layer embedded in or neighboring the mirror plane, so that when the display unit is deactivated the display area is fully reflective, particularly as reflective as the mirror plane itself.

[0014] The sanitary mirror device includes a sensor unit that allows contactless measuring of body characteristics using electromagnetic radiation such as radar, visible light, or infrared light based measurements.

[0015] According to an embodiment the sensor unit may comprise a radar sensor unit configured to perform a Doppler radar measurement to detect the body characteristics data.

[0016] Specifically, the body characteristics comprise a heart rate, a respiratory rate, and/or blood pressure.

[0017] Furthermore, the radar sensor unit may have a radar sensor and an analyzing unit to process radar signals, wherein the radar unit is configured to provide radar signals and comprise at least one antenna, wherein the antenna is provided as one of a part of a frame circumventing the mirror plane, an area of a metal layer forming the mirror plane which is galvanically isolated or any other configuration where the radar radiation is not blocked or distorted by a metal layer of or in the mirror element.

[0018] So, the sensor unit may include a radar sensor unit that has a radar sensor and an analyzing unit to apply measurements on the individual being in front of the sanitary mirror device. The radar sensor unit is configured to detect micromotion in the body of the individual, the resulting radar signals can be analyzed in the analyzing unit, particularly using machine learning methods, to obtain a heart rate and/or a respiratory rate and/or a blood pressure information.

[0019] Detecting heart rate and respiratory rate using

Doppler radar measurements is well known in the art, e.g. from documents R. Fletcher et al., "Low-Cost Differential Front-End for Doppler Radar Vital Sign monitoring," IEEE MTT-S International Microwave Symposium Digest, pp.1325-1328, 2009 and Young Woo Choi et al, "Micro-Doppler simulator of bulk and micro motions for vehicle drivers", IEEE, 2016 International Conference on Information and Communication Technology Convergence (ICTC) 19-21 Oct. 2016.

[0020] Furthermore, blood pressure can also be measured using Doppler radar technology as known from document Tomoyuki Ohata et al.,. "Non-Contact Blood Pressure Measurement Scheme Using Doppler Radar", Annu Int Conf IEEE Eng Med Biol Soc, 2019 Jul.

[0021] The Doppler radar micro motion measurement can be applied in a single antenna and dual antenna technology and is sensitive to the motion of body parts such as lungs and heart to detect respiratory and heart beat motions. From these motions respiratory rate, blood pressure, and heart rate can be derived using appropriate well-known signal processing technology.

[0022] Moreover, the sensor unit may comprise a camera configured to detect a skin color of the individual in front of the mirror device as a body characteristics.

[0023] It may be provided that the sensor unit comprises an infrared camera or an infrared temperature sensor which is configured to detect a body temperature as a body characteristics.

[0024] According to an embodiment, the control unit may be configured to generate or to retrieve information from an internal storage unit and/or a remote storage unit associated with the obtained body characteristics data and to display the retrieved information on the display area of the display unit.

[0025] Furthermore, the control unit may be configured to track the body characteristics data over time associated with an identification of the individual the body characteristics data belong to, wherein the identification is manually input or automatically made by means of a camera image of the individual taken at the time of detecting body characteristics data and by applying well-known face recognition techniques.

Brief description of the drawings

[0026] Embodiments are described in more detail in conjunction with the accompanying drawings in which:

Figure 1 is a block diagram illustrating the components of the sanitary mirror device according to the present invention.

Description of Embodiments

[0027] Figure 1 schematically shows the sanitary mirror device 1 according to the present invention. The sanitary mirror device 1 includes a mirror element 2 with a mirror plane for providing a mirror image of objects and individuals being present in front of the mirror element 2. The mirror element 2 is usually attached to a wall (e.g. in parallel to the wall), particularly in a bathroom or in a sanitary facility.

[0028] The mirro device 1 may be provided with a display unit 3 having a display area. The display unit 3 may be formed as an LCD-display with backlight or as a Micro LED display. Display unit 3 can be provided neighboring the mirror element 2, such as below the mirror plane of the mirror element 2. Preferably, the display area of display unit 3 is arranged behind a semi-transparent reflective layer. The semi-transparent layer is at least provided at the portion of the mirror plane. When display unit 3 is deactivated the display area is black and does not emit any light. Due to the semi-transparent layer, the mirror plane is continuously reflective even in the portion of the mirror plane behind which the display area is located. Therefore, the display area acts like the rest of the mirror plane. Furthermore, when display unit 3 is activated it allows displaying information to a user in front of the mirror element 2.

[0029] Preferably, the mirror element 2 is formed by a glass screen which is coated with a metal layer on its backside wherein in the portion of the mirror plane where the display unit is arranged the metal layer is thinned to make the metal layer semi-transparent so that an image presented by the display unit 3 shines through the semi-transparent metal layer. This allows the metal semi-transparent layer to act as a mirror when the display unit 3 is deactivated and to perceive the display image through the mirror plane when the display unit 3 is activated.

[0030] Furthermore, the sanitary mirror device 1 may include a sensor unit 4 with one or more sensors to obtain sensor information. The sensor unit 4 will be particularly configured to obtain body characteristics of an individual being present in front of the mirror element 2 and to display the body characteristics or information related thereto to immediately inform the individual while the individual is using the mirror device e.g. to check their outer appearance.

[0031] The sensor unit 4 may comprise a radar sensor unit 41. The radar sensor unit 41 has a radar unit 41a and an analyzing unit 41b which are configured to performs a Doppler radar measurement to obtain a micro-motion radar signal of the individual's body. The micro-motion radar signal can be analyzed in the analyzing unit 41b to obtain a heart rate and/or a blood pressure and/or a respiratory rate and the like. Methods for determining the above body characteristics using Doppler radar measurements are well known in the art as indicated in the introduction and are not further explained herein.

[0032] Basically, the radar unit 41a can be of a single antenna or dual antenna type. A dual antenna type radar unit 41 has a transmitting antenna 41c and a receiving antenna 41d which allows the radar unit to obtain a Doppler radar signal which can be analyzed in the analyzing unit 41b. As the radar antennas 41c, 41d are less efficient behind the metal layer of the mirror element 2, the trans-

mitting and receiving antenna 41c, 41d may be arranged at an edge of the mirror element 2, particularly in or on a frame part 6 at least partly surrounding the mirror element 2.

[0033] Alternatively, mirror element 2 may be provided with openings 41f in the metal layer in which at least one of the transmitting and receiving antennas may be arranged.

[0034] The transmitting and receiving antennas in the opening 41f may be formed as an antenna layer made of an optically reflective and electrically conductive metal which is galvanically isolated from the rest of the metal layer of the mirror element 2. This allows forming antenna elements for the radar sensor unit 41 which may be separated from the rest of the metal layer by a gap 41g that is preferably smaller than 5 mm.

[0035] The radar sensor unit 41 can be further provided with and be connected with a multiple antenna arrangement where one or more additional antennas 41j are placed at multiple locations (such as left and right of the mirror device 1) to acquire a more detailed signal for the radar sensor unit 41 to process.

[0036] The sensor unit 4 may further be provided with an infrared camera 42 or an infrared temperature sensor which is directed to a position in front of the mirror element 2 which allows obtaining a body temperature as a body characteristics of an individual.

[0037] The sensor unit 4 may further be provided with a room temperature sensor 43 to detect an ambient temperature.

[0038] A control unit 5 is provided which is in communication with the sensor unit 4 and with the display unit 3. The control unit 5 may include a data processing unit and be in control of the displaying of the measured body characteristics on the display area of display unit 3 and further additional information such as an ambient temperature.

[0039] Further additional information can be provided and displayed on the display unit 3, such as warnings, e.g. if a critical condition is detected. For instance, it can be checked if a critical condition has occurred if any of the heart rate, blood pressure and respiratory rate is too high or too low. In case of a critical condition a warning signal can be displayed and/or advice can be given to the individual.

[0040] Furthermore, the control unit 5 may be in connection with a storage unit 7 to collect and timely track the measured body characteristics each time a measurement has been carried out to obtain a timeline of the body characteristics e.g. for medical analysis and/or supervision. The storage unit 7 may be integrated with the mirror device 1 or can be cloud-based when the control unit 5 is equipped with an optional data communication unit 51 to transmit body characteristics over a network, such as the Internet, to the cloud-based storage unit.

[0041] The control unit 5 may have communication means to e.g. communicate with a Home IoT unit. If the user configures his or her Home IoT system to be connected to the smart mirror device 1, he or she will be able to get the information from the control unit 5 to this Home IoT network. A mobile device can be used to retrieve the data and see the graphs of blood pressure, temperature reading etc. over a predetermined time frame such as a week, a month etc. This functionality is configurable so that user can enable or disable the communication of data from control unit 5 to external devices. This data can also be directly retrieved from the control unit 5 by the mobile device.

[0042] The timeline of the body characteristics can be stored associated to a user which can be identified by manual input. Therefore, an input device (not shown) can be separately provided or can be implemented as a touch sensor surface on the display area of the display unit 3. The touch sensor may be configured in conjunction with the control unit 5 to make selections from menus or choices displayed on the display area so that an identification of the individual presently using the mirror device can be manually input by the user.

[0043] The sensor unit 4 may further be provided with and or coupled to a camera 44 which is directed to a position in front of the sanitary mirror device 1 in which the individual using the mirror device is usually positioned. An image taken by the camera 44 may be used to automatically identify the individual in front of the mirror device 1 applying well known face recognition techniques in the control unit 5 or the cloud. So, the body characteristics can be stored in conjunction with the identification of the specific individual the currently obtained body characteristics belong to. Thereby, different data sets of timelines of body characteristics can be kept in association with a specific individual if the mirror device is used by a plurality of individuals.

[0044] Furthermore, the camera 44 can be used as an additional sensor for detecting the skin color of the individual, particularly at a predetermined body position, so that the skin color can be tracked over time as a body characteristics. The control unit 5 making use of specific databases stored in the storage unit or a cloud storage can make use of an expert system for patterns which may indicate illness symptoms of the individual by analyzing the timelines of the body characteristics stored.

Claims

1. A sanitary mirror device (1), comprising:

- a mirror element (2) having a reflective mirror plane;
- a sensor unit (4) including one or more sensors (41, 42, 43, 44) which are configured to detect body characteristics data in a contactless manner, the body characteristics data corresponding to or related to at least one body characteristics of an individual in front of the mirror device (1);
- a display unit (3);

- a control unit (5) configured to receive the body characteristics data and to instruct the display unit (3) to display information corresponding to and/or relating to the body characteristics data.

2. The sanitary mirror device (1) according to claim 1, wherein the display unit (3) is integrated with the mirror element (2) so that a display area of the display unit (3) is embedded or directly abuts to the mirror plane.

3. The sanitary mirror device (1) according to claim 2, wherein the display area is formed as a semi-transparent layer in or neighboring the mirror plane, so that when the display unit (3) is deactivated the display area is reflective, particularly as reflective as the mirror plane.

4. The sanitary mirror device (1) according to any of the claims 1 to 3, wherein the sensor unit (3) comprises a radar sensor unit (41) configured to perform a Doppler radar measurement to detect the body characteristics data.

5. The sanitary mirror device (1) according to claim 4, wherein the body characteristics comprise a heart rate, a respiratory rate, and/or blood pressure.

6. The sanitary mirror device (1) according to any of the claims 4 to 5, wherein the radar sensor unit (41) has a radar unit (41a) and an analyzing unit (41b) to process radar signals, wherein the radar unit (41a) is configured to provide radar signals and comprise at least one antenna (41c, 41d), wherein the at least one antenna (41c, 41d) is provided as one of a part of a frame circumventing the mirror plane, or an area of a metal layer forming the mirror plane which is galvanically isolated from the rest of the mirror plane.

7. The sanitary mirror device (1) according to claim 6, wherein an additional antenna (41j) is provided external to the arrangement of the mirror element (2), the control unit (5) and the display unit (3).

8. The sanitary mirror device (1) according to any of the claims 1 to 7, wherein the sensor unit (4) comprises a camera (44) configured to detect a skin color of the individual in front of the mirror device as a body characteristics.

9. The sanitary mirror device (1) according to any of the claims 1 to 8, wherein the sensor unit (4) comprises an infrared camera (42) or an infrared temperature sensor (43) which is configured to detect a body temperature as a body characteristics.

10. The sanitary mirror device (1) according to any of the claims 1 to 9, wherein the control unit (5) is configured to generate or to retrieve information from an internal storage unit and/or a remote storage unit associated with the obtained body characteristics data and to display the retrieved information on the display area of the display unit (3).

11. The sanitary mirror device (1) according to any of the claims 1 to 10, wherein the control unit (5) is configured to track the body characteristics data over time associated with an identification of the individual the body characteristics data belong to, wherein the identification is manually input or automatically made by means of a camera image of the individual taken at the time of detecting body characteristics data and by applying face recognition techniques.

Amended claims in accordance with Rule 137(2) EPC.

1. A sanitary mirror device (1), comprising:

- a mirror element (2) having a reflective mirror plane;
- a sensor unit (4) including one or more sensors (41, 42, 43, 44) which are configured to detect body characteristics data in a contactless manner, the body characteristics data corresponding to or related to at least one body characteristics of an individual in front of the mirror device (1);
- a display unit (3);
- a control unit (5) configured to receive the body characteristics data and to instruct the display unit (3) to display information corresponding to and/or relating to the body characteristics data, wherein the sensor unit (3) comprises a radar sensor unit (41) configured to perform a Doppler radar measurement to detect the body characteristics data.

2. The sanitary mirror device (1) according to claim 1, wherein the display unit (3) is integrated with the mirror element (2) so that a display area of the display unit (3) is embedded or directly abuts to the mirror plane.

3. The sanitary mirror device (1) according to claim 2, wherein the display area is formed as a semi-transparent layer in or neighboring the mirror plane, so that when the display unit (3) is deactivated the display area is reflective, particularly as reflective as the mirror plane.

4. The sanitary mirror device (1) according to claim 1, wherein the body characteristics comprise a heart rate, a respiratory rate, and/or blood pressure.

5. The sanitary mirror device (1) according to any of

the claims 1 to 4, wherein the radar sensor unit (41) has a radar unit (41a) and an analyzing unit (41b) to process radar signals, wherein the radar unit (41a) is configured to provide radar signals and comprise at least one antenna (41c, 41d), wherein the at least one antenna (41c, 41d) is provided as one of a part of a frame circumventing the mirror plane, or an area of a metal layer forming the mirror plane which is galvanically isolated from the rest of the mirror plane.

6. The sanitary mirror device (1) according to claim 5, wherein an additional antenna (41j) is provided external to the arrangement of the mirror element (2), the control unit (5) and the display unit (3).

7. The sanitary mirror device (1) according to any of the claims 1 to 6, wherein the sensor unit (4) comprises a camera (44) configured to detect a skin color of the individual in front of the mirror device as a body characteristics.

8. The sanitary mirror device (1) according to any of the claims 1 to 7, wherein the sensor unit (4) comprises an infrared camera (42) or an infrared temperature sensor (43) which is configured to detect a body temperature as a body characteristics.

9. The sanitary mirror device (1) according to any of the claims 1 to 8, wherein the control unit (5) is configured to generate or to retrieve information from an internal storage unit and/or a remote storage unit associated with the obtained body characteristics data and to display the retrieved information on the display area of the display unit (3).

10. The sanitary mirror device (1) according to any of the claims 1 to 9, wherein the control unit (5) is configured to track the body characteristics data over time associated with an identification of the individual the body characteristics data belong to, wherein the identification is manually input or automatically made by means of a camera image of the individual taken at the time of detecting body characteristics data and by applying face recognition techniques.

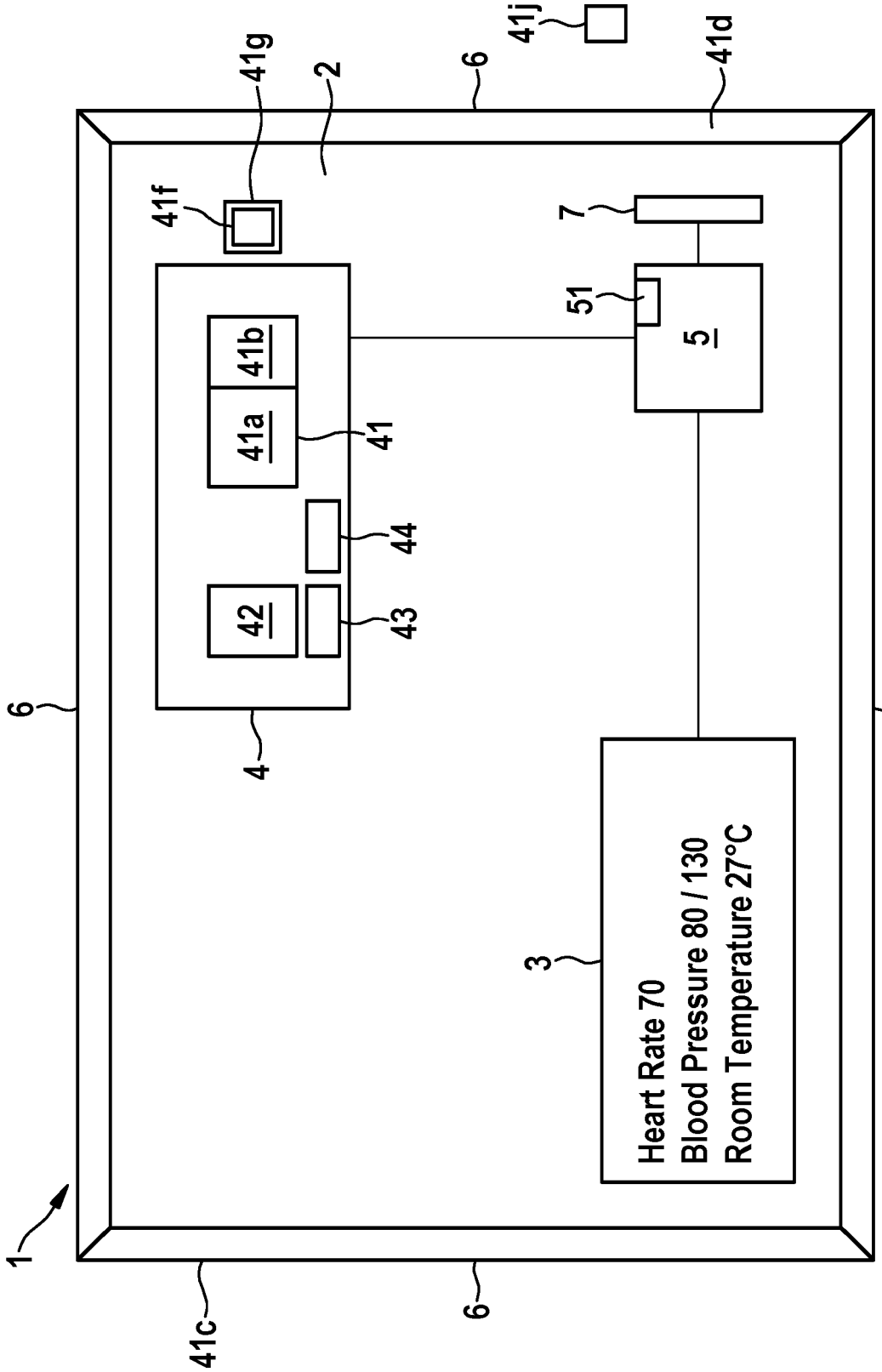
41j
41g
2
6
41d
41f
7
51
5
41b
41a
41
44
42
43
4
6
6
3
Heart Rate 70
Blood Pressure 80 / 130
Room Temperature 27°C
1
41c
6

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 21 17 7054

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2018/060232 A1 (KONINKLIJKE PHILIPS NV [NL]) 5 April 2018 (2018-04-05) * page 2, lines 18-30 - page 4, lines 32-34 * * page 5, lines 1-27 - page 6, lines 3-22,29-34 * * page 7, lines 10,26-34 - page 8, lines 15-34 * * page 9, lines 1-4,32,33 - page 10, lines 1-34 * * page 11, lines 1-31,32-34 - page 12, lines 1-8,32-34; figures 1-3 *	1-3,8-11 4,5	INV. A47G1/02
X	WO 2018/045649 A1 (LAUNCH TECH CO LTD [CN]) 15 March 2018 (2018-03-15) * abstract; figures 1-6 *	1,2,8, 10,11	
X	CN 111 977 985 A (KOHLER CHINA INVEST CO LTD) 24 November 2020 (2020-11-24) * figures 1-15 *	1-3,8,10	
X	CN 108 920 509 A (SHENZHEN SAIYI TECH DEVELOPMENT CO LTD) 30 November 2018 (2018-11-30) * figures 1,2 *	1-3,8	TECHNICAL FIELDS SEARCHED (IPC) A47G A45D
Y	US 2008/126129 A1 (MANZO ROBERTO P [US]) 29 May 2008 (2008-05-29) * paragraphs [0021], [0068] *	4,5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 September 2021	Longo dit Operti, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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29-09-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2018060232 A1	05-04-2018	CN 109982616 A	05-07-2019
		EP 3518710 A1	07-08-2019
		US 2021274912 A1	09-09-2021
		WO 2018060232 A1	05-04-2018
WO 2018045649 A1	15-03-2018	CN 106343833 A	25-01-2017
		WO 2018045649 A1	15-03-2018
CN 111977985 A	24-11-2020	NONE	
CN 108920509 A	30-11-2018	NONE	
US 2008126129 A1	29-05-2008	AT 32570 T	15-03-1988
		EP 0081599 A1	22-06-1983
		US 2004202685 A1	14-10-2004
		US 2008126129 A1	29-05-2008
		WO 2004091501 A2	28-10-2004

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Non-patent literature cited in the description

- **R. FLETCHER et al.** Low-Cost Differential Front-End for Doppler Radar Vital Sign monitoring. *IEEE MTT-S International Microwave Symposium Digest,* 2009, 1325-1328 **[0019]**
- **YOUNG WOO CHOI et al.** Micro-Doppler simulator of bulk and micro motions for vehicle drivers. *IEEE, 2016 International Conference on Information and Communication Technology Convergence (ICTC),* 19 October 2016 **[0019]**
- **TOMOYUKI OHATA et al.** Non-Contact Blood Pressure Measurement Scheme Using Doppler Radar. *Annu Int Conf IEEE Eng Med Biol Soc,* July 2019 **[0020]**