(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 615 187 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.01.2006 Bulletin 2006/02

(51) Int Cl.:
G08B 25/01 *(2006.01)* ***G06F 19/00*** *(2006.01)*
A61B 5/00 *(2006.01)*

(21) Application number: **05105609.1**

(22) Date of filing: **23.06.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

(30) Priority: **06.07.2004 FI 20045266**

(71) Applicant: **IST International Security Technology OY**
00210 Helsinki (FI)

(72) Inventors:
- **Särelä, Antti**
  02140, Espoo (FI)
- **Myllymäki, Marko**
  00440, Helsinki (FI)

(74) Representative: **LEITZINGER OY**
Tammasaarenkatu 1
00180 Helsinki (FI)

(54) Personal safety device detecting its removal from a wearer

(57) The invention relates to a security device system, comprising a wearable alarm device fastenable to the wrist or elsewhere in the body or an instrument measuring physiological signals or a combination thereof, and a data terminal (6) capable of receiving messages and information from a wearable device (1). The wearable device (1) has a measurement-based identification about the device being attached to a wearer, said identification being processed for status data. The data terminal (6) has a user interface for displaying the measured status data graphically.

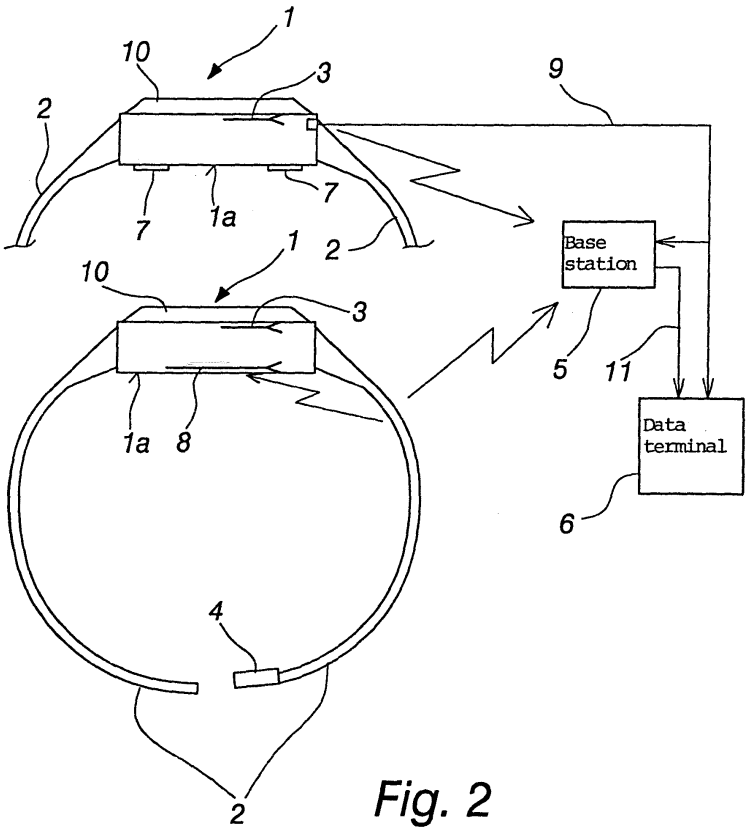

Fig. 2

EP 1 615 187 A1

Description

[0001] Security phone is one of the commonly used emergency devices in an effort to improve safety for seniors and to promote independent living as much as possible at home, as well as in various types of nursing homes. A security phone system comprises generally a wrist unit or a pendant, provided with an alarm button. The button includes a small short-range radio transmitter for transmitting an emergency message to a base station present in the residence. The base station is connected to a telephone network and it transmits the button-sent emergency message further to a receiver. The receiver is generally a call center, which includes computer equipment for receiving alarms and messages coming from base stations over a telephone network. The alarm can also be transmitted as a voice message or the like, for example to home attendants' mobile phones. After receiving an alarm, the receiver can place a call to the participant who has activated the alarm. The voice link can be established over the base station's speaker phone in case the participant him/herself is unable to answer the call.

[0002] One of the major shortcomings in available security phone systems is that the participant is often forgetful of wearing the button, which may be a wrist unit or a pendant. In a sudden emergency, for example when an elderly person falls, the alarm device is not accessible in this case. According to a British study, 27-40% of those using a security phone do not wear an alarm device at all or only wear it randomly [Porteus J., Brownsell S. Exploring technologies for independent living for older people, Anchor Trust, Oxon, UK, 2000, p. 60]. Thus, it can be estimated that even people in possession of a safety appliance spend in reality more than 30% of their time without the safeguard. Neither has the security service provider a possibility of monitoring use of the device, nor to make sure that clients covered by the service would indeed receive help when they need it.

[0003] Another problem results if the wrist unit is used for automatic access control, for example in the case of people with dementia. In IST's Vivago system, the wrist unit in possession of an elderly person, which is provided with an emergency button, functions also as an active component in access control. The wrist unit transmits radio messages continuously to base stations. When a person wearing the wrist unit, whose exit needs to be detected, passes close by a base station present next to the door, the wrist unit sends to the base station an identifier which is transmitted as an access control message to the receiver of alarms. It is thereby discovered that the wrist unit is located in the proximity of the door. Since messages are sent by the wrist unit continuously to base stations, the base station may also transmit to the receiver a disconnection message regarding the absence of wrist unit -sent messages, which means that the participant has left his/her residence.

[0004] Access control is based on the supervised person wearing continuously a wirelessly communicating identifier. Thus, the receiver of alarms should also be informed in the event that the participant him/herself has removed the discussed identifier, for example unfastened the wrist unit from his/her hand. If the alarm wrist unit, functioning as an identifier, is not attached to the hand, access control is naturally also inoperative.

[0005] A third problem relates to wearable instruments measuring physiological signals. These include, for example, aktigraphs used in sleep analysis and worn around the wrist like a wristwatch, and IST's Vivago wrist unit, in which aktigraphy type measuring technology is combined with a safety alarm as described above. These instruments are used for measuring movements of the arm. In aktigraphs, the measurement data accumulates in the memory of a wrist unit, from which it is down loaded after a test period (e.g. 2 weeks) to a PC along a cable. In the Vivago system, the measurement data is transmitted in real time wirelessly by an rf-transmitter from a wrist unit to a base station, from which it can be conveyed in various ways to a measurement-data receiving PC for further analysis. The measurement data is processed in the PC for a so-called activity curve, which represents human motion activity. Generally, the activity is studied and analysed over a preceding period of several days in order to discover better for example anomalies in the participant's circadian rhythm or quality of sleep.

[0006] If the participant disengages such a device from his/her hand, it is naturally no longer capable of measuring movements of the arm. Such occasions appear as gaps in a measuring signal, but these are impossible to distinguish from the events that the device has ceased to operate for some other reason, like as a result of the battery going flat, a technical defect or the like. If the device transmits data in a wireless manner, no data necessarily accumulates from outside the radio transmitter's range, which also appears as a gap in measurement data. Having such instruments firmly attached to the hand is also important for the actual measurement. If the attachment is poor, the measuring signal may deteriorate, affecting the signal-based analysis. For these reasons, it would be highly preferential in the process of analysing measurement data to have knowledge of whether the wrist unit has been attached to the hand or whether there is some other reason for the gap. The problem applies generally to all wearable instruments used for measuring physiological signals. Regarding the subsequent analysis of measurement data, it is beneficial to know whether the device, and especially the sensor system, has been appropriately attached to the wearer.

[0007] The above problems can be eliminated by means of a security device system of this invention, which has characterizing features as defined in the appended claim 1.

[0008] The invention will now be described in more detail by way of an exemplary embodiment with reference to the accompanying drawings, in which

Fig. 1a is a graph of status data;

Fig. 1b is a graph of status data in combination with activity measurement. The black curve represents the participant's motion activity. The grey bar (which is coloured, e.g. yellow, on the display of a data terminal) below the graph represents time that the device has not been in contact with the hand; and

Fig. 2 shows one exemplary embodiment for the system in a block diagram.

[0009] According to the invention, a wearable device 1, which can be an emergency button, an instrument measuring physiological signals or a combination thereof, includes a measurement-based automatic detection to indicate that the participant is wearing the device. When left on a table, for example, the device records the status and transmits the data forward to a receiver of alarms or measurement data. It is part of the invention that the receiver is capable of using a data terminal 6 to detect graphically in various ways that the device is not worn by its user. The data terminal 6 can be for example a computer, provided with a special reception program, or a mobile phone.

[0010] A measurement, based on which the device automatically identifies that it is being worn, can be performed in several ways. One method comprises a measurement of impedance, i.e. the electrical conductivity of a medium. If the device is a wrist unit 1, 2, its bottom la can be provided with two separate contact surfaces 7, the impedance of a medium being measurable across the area therebetween. The impedance produced by the skin of a hand is about 100 kohm/cm^2, while air does not conduct electricity at all at discussed potentials. If between the wrist unit's contacts 7 is established a direct voltage or a low-frequency alternating voltage, it is possible to infer, by measuring the electric current passing between the contacts 7, whether there is some conductive medium or air between the contacts. Based on this, it is possible to further infer whether or not the wrist unit is in contact with a hand. There are several prior known ways of measuring a current.

[0011] A second method is capacitive, wherein the above-mentioned contact surfaces 7 make up a capacitor which has its capacitance varying in relation to the permittivity of a medium present between the contacts 7. Respectively, it is then possible to distinguish a change of capacitance caused by a hand from having air between the contacts 7. If the device is provided with an rf-transmitter, the latter can also be used in identification. A part of the device next to the skin, such as the bottom 1a, can be designed to include a small antenna 8 for listening to the device's own rf-transmission. The device has its actual transmitting antenna 3 located as far from the skin as possible for a best possible efficiency. During the device's own rf-transmission, the bottom-fitted antenna 8 is also induced with a current whose strength depends on whether or not the wrist unit is close to the skin. If the wrist unit is in contact with a hand, the antenna 8 next to it couples at rf-frequencies with the hand and the induced current during transmission is different from what it is when the wrist unit is out of contact with a hand and the antenna 8 is surrounded by air.

[0012] Whether or not the device is in contact with a hand can also be concluded by measuring a bottom temperature of the device 1, which is also different when the device is in contact with the skin from what it is surrounded by air.

[0013] The device may also simply measure engagement data regarding, for example in the case of a wrist unit 1, 2, whether a clasp 4 is on or off.

[0014] In view of the invention, it is not essential as to which method is applied for obtaining measurement data. What is important is that the device identifies a status automatically without the participant him/herself having to consciously inform the device of the status.

[0015] According to the invention, the device informs a receiver of not being worn by the participant, the receiver processing the device-sent alarm, status or measurement data as appropriate. The information can be transmitted in real time or after a given delay through a base station 5 to the receiver's data terminal 6, such as a PC. The information can be transmitted either separately as an independent message or jointly with measurement data. In view of the invention, it is not essential as to which method is applied for informing a receiver of the device's contact status as the inventive system has a capability of using whichever appropriate method is called for. In reference to the alarm wrist unit 1, 2, for example, the information can be transmitted by the wrist unit's rf-transmitter to the base station 5, which is present in the residence and which relays the information by means of a modem over a public telephone network with the use of DTMF signals to the PC 6 present at a call center, from which the receiver is able to see the information.

[0016] An essential feature of the invention is that the status data can be presented graphically on the display of a receiver's data terminal 6. The graphic display can be for example a presentation as shown in fig. la, consisting of vertically arranged time segments of 24 h, representing successive days, and having drawn therein a screened bar representing the time that the device has not been worn by the participant. When the bar is blank, the device is in active service. The current service status is also separately displayed on the screen, provided that the information travels in real time. The status data can also be used for working out the using rate for a given period in terms of percentage. The status data can also be scanned back in time. The figure shows that the participant has had the device off his/her hand every night since 5.6. In addition, he/she has removed the device several evenings for a couple of hours. Based on this information, the receiver can advise the user to wear the

device also at nights.

[0017] Alternatively, the status data can be presented on a single display jointly with measurement data as shown in fig. 1b. The depicted graph represents the participant's motion activity from the period of 4 days, wherein the graphic display has at its bottom a coloured bar to indicate points of time at which the device has not been worn. The figure shows gaps of a measuring signal in three nights and simultaneously the coloured bar (grey in the figure) indicates that the device has not been in contact with the hand. The participant habitually removes the device every evening at 19-20 o'clock. One night (26.1.), the participant has worn the device, yet in the preceding evening of 25.1. he/she has removed the device at the usual time for a couple of hours.

[0018] In view of the invention, it is not essential by which graphic method or in conjunction of which measurement data the status data will be displayed on the screen of a data terminal 6. What is essential is the receiver's ability to receive the information visually. Neither is it essential whether the displayed information comprises real-time data or historical data needed subsequently in the process of analysing the measurement data. Figs. 1a and 1b illustrate two plausible ways of presenting status data. Just a quick glance at the graphic display is enough for the receiver to verify when the device has been active. Figs. 1a and 1b demonstrate that the participant has not usually worn the device at night. Based on this information, the receiver may then for example advise the participant to wear the security wrist unit 1, 2 or a measuring instrument also at night for the sake of his/her safety or uninterrupted data collection.

[0019] One highly preferred application of the invention can be implemented for a combination of an emergency button 10 and an instrument 1 measuring physiological signals, such as for IST's Vivago system. This system comprises a wrist unit 1, 2 provided with an emergency button 10 and a sensor measuring the participant's motion activity. The wrist unit 1, 2 is provided with a sensor system 7 based on the change of capacitance for verifying whether the wrist unit is on a person's hand. The wrist unit includes a short-range rf-transmitter, enabling it to communicate alarms, an activity measuring signal, as well as a range of status data to a base station 5 present in the residence. The base station 5 is linked over a telephone network 11 or another communication line to a receiving PC 6. The base station 5 transmits the measurement and status data, supplied by the wrist unit 1, 2, either in real time or at certain time segments to the receiver. The PC 6 is provided with a reception program, the screen of which can be used for displaying alarms, measurement and status data concerning every participant engaged in the system. The reception program can be used for a graphic display of both real-time and previously developed status data regarding use of the wrist unit, jointly with a motion-activity representing graph as in fig. 1b.

[0020] Benefits offered by the method and technology:

- Receiver is able to monitor the use of security device 1, 2 and to advice a participant to wear the device -> usage rate of the device rises -> the participant's safety increases.
- As the usage rate of safety button 10 rises, the receiving organisation, such as a call center is able to factually provide even better service, being able to guarantee a continuous safety coverage for their clients.
  Measurement data can be used for working out each client's usage rate of the device in terms of percentage, which can be monitored and used as an indicator in developing the service.
- If the device functions as an identifier for access control, the attending staff can immediately intervene in the event that a participant him/herself has removed the identifier. It is further possible to detect repeated occasions of a participant deactivating the device, such as night-time or the like, making it easier to anticipate such behaviour.
- If the question is about a measuring instrument 1, 2, it is possible, in the process of analysing measurement data, to account for occasions in which the device has not been worn by a participant and to distinguish those occasions from other signal- gaps inducing occurrences, such as technical malfunctions. Based on this information, a person wearing the device can be advised in proper use of the device.
- With the help of a graphic presentation, the receiver is able to quickly obtain essential information about usage rate of the device by just a glance at the data terminal. In long-term measurements of up to several months, it is possible to browse through past data and to observe frequent occasions of the device out of service. This improves the analysis of measurement data.
- The required technology is readily feasible for an existing security phone system, which involves a wearable wrist unit 1, 2 and a base station 5 apt for setting up in the residence. The implementation requires no accessories.
- A sensor system 7, 8, capable of detecting whether the device is in service, is feasible for the wrist unit 1, 2 by several preferred, simple and prior known procedures.
- Transfer and storage of status data can be managed by using the same technology that is applied for other information coming from an alarm or measuring device.
- Graphic presentation of status data is readily and

preferably feasible for existing available reception programs, either as a separate display or by combining a display of status data with other display techniques.

Claims

1. A security device system, comprising a wearable alarm device fastenable to the wrist or elsewhere in the body or an instrument measuring physiological signals or a combination thereof, and a data terminal (6) capable of receiving messages and information from a wearable device (1), **characterized in that** the wearable device (1) has a measurement-based identification about the device being attached to a wearer, said identification being processed for status data, and the data terminal (6) has a user interface for displaying the measured status data graphically.

2. A system as set forth in claim 1, wherein an attachment identification for the wearable device (1) is effected by a capacitive measurement.

3. A system as set forth in claim 1, wherein an attachment identification for the wearable device (1) is effected by measuring the impedance of a medium between contacts (7) present in the device.

4. A system as set forth in claim 1, wherein an attachment identification for the wearable device is effected by indicated locking of a clasp (4) present in a strap of the device.

5. A system as set forth in claim 1, wherein an attachment identification for the wearable device is effected during the transmission of an rf-transmitter present in the device by measuring a current inducing in a second antenna (8) isolated from the transmitter.

6. A system as set forth in claim 1, wherein an attachment identification for the wearable device is effected by measuring the temperature of a part of the device which is in contact with the skin.

7. A system as set forth in any of claims 1-6, wherein the wearable device is a wrist unit (1, 2).

8. A system as set forth in any of claims 1-6, wherein the wearable device is attached by the strap (2) to a wearer.

9. A system as set forth in any of claims 1-8, wherein the wearable device transmits status data wirelessly to a base station (5).

10. A system as set forth in any of claims 1-8, wherein the status data can be loaded from the wearable device (1) by means of a cable (9) coupled thereto.

11. A system as set forth in any of claims 1-10, wherein the data terminal (6) is a computer provided with a program for receiving and displaying status data.

12. A system as set forth in any of claims 1-10, wherein the data terminal (6) is a mobile phone provided with a program for receiving and displaying status data.

13. A system as set forth in any of claims 1-10, wherein the data terminal (6) is a PDA device (Personal Digital Assistant) provided with a program for receiving and displaying status data.

14. A system as set forth in any of claims 1-13, wherein the data terminal's (6) program displays status data graphically as a time bar.

15. A system as set forth in any of claims 1-13, wherein the data terminal's (6) program displays status data graphically in conjunction with physiological measurement data.

16. A system as set forth in any of claims 1-13, wherein the data terminal's (6) program displays status data as a symbol.

17. A system as set forth in any of claims 1-13, wherein the data terminal (6) has a capability of displaying the usage rate of the wearable device in percentage.

18. A system as set forth in any of claims 1-17, wherein the data terminal's (6) program has a capability of browsing status data back in time.

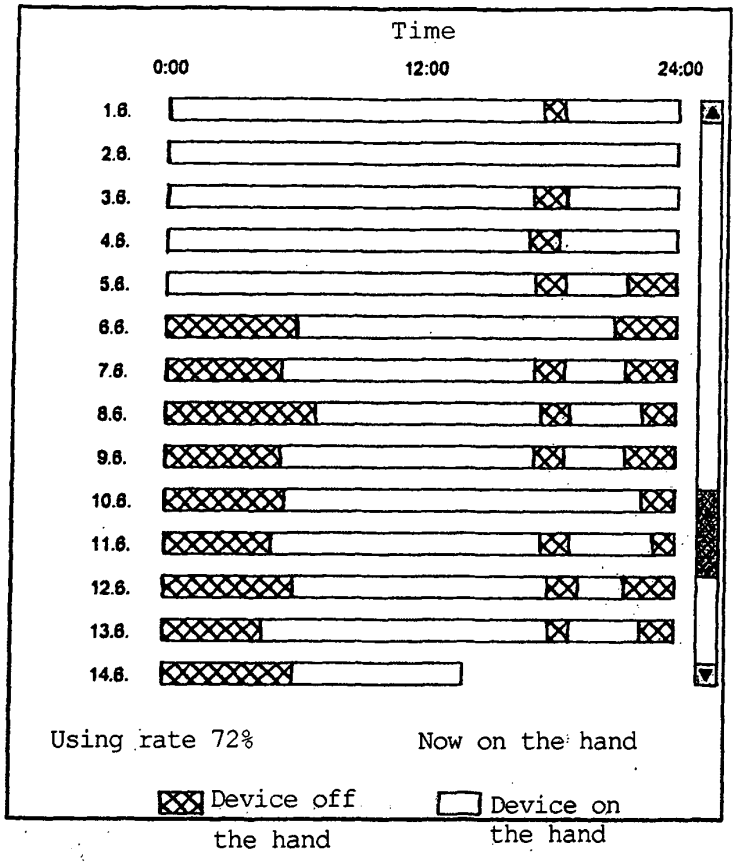
Time
0:00
12:00
24:00
1.6.
2.6.
3.6.
4.6.
5.6.
6.6.
7.6.
8.6.
9.6.
10.6.
11.6.
12.6.
13.6.
14.6.
Using rate 72%
Now on the hand
Device off the hand
Device on the hand

Fig. 1a

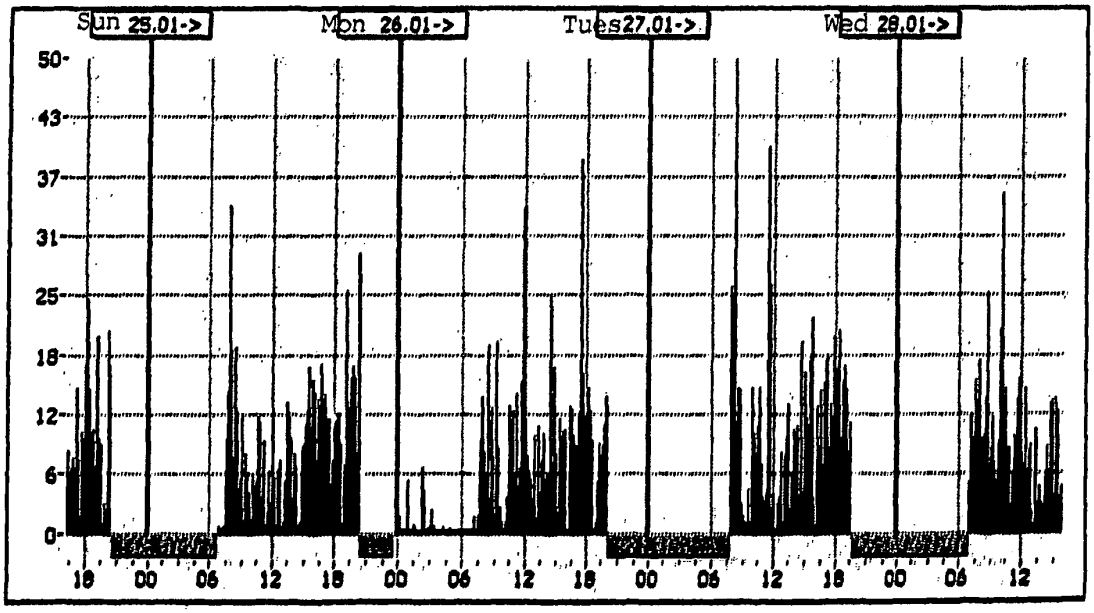
Sun 25.01->
Mon 26.01->
Tues27.01->
Wed 28.01->
50
43
37
31
25
18
12
6
0
18
00
06
12

Fig. 1b

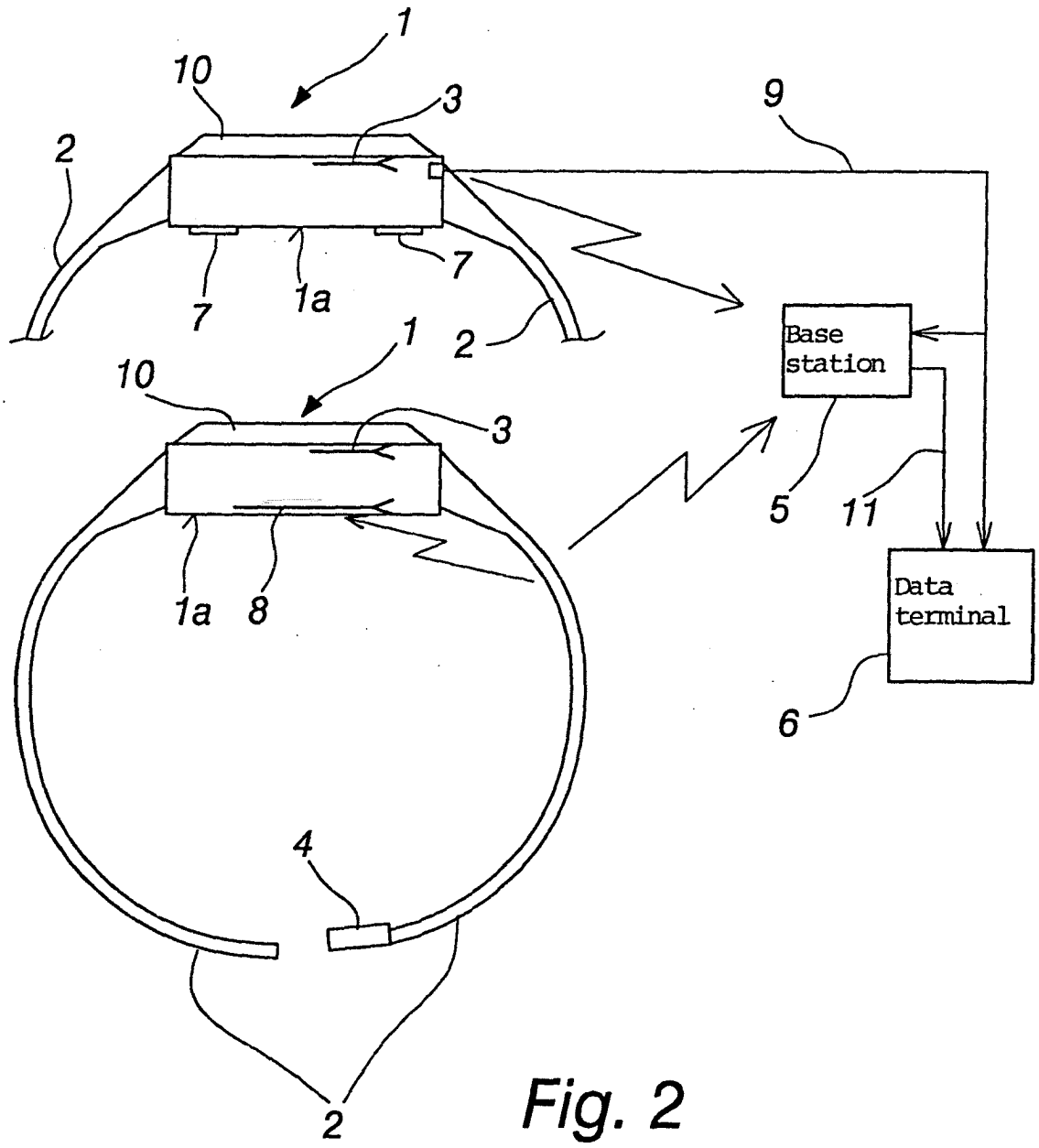

Fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 10 5609

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 6 072 392 A (HENDERSON ET AL) 6 June 2000 (2000-06-06) * abstract * * column 1, line 66 - column 2, line 47 * * column 3, lines 1-5 * * column 7, lines 27-50 * * figures 1,7,15-17,21-23 *	1,4,7,8	G08B25/01 G06F19/00 A61B5/00
X	US 2003/069714 A1 (WIGLEY FREDRICK M ET AL) 10 April 2003 (2003-04-10) * abstract * * paragraphs [0002], [0007] - [0009], [0017], [0023], [0026] * * figures 1-4 *	1-3,5,6, 9-18	
A	US 5 982 285 A (BUECHE ET AL) 9 November 1999 (1999-11-09) * abstract * * column 1, lines 16-18,45-65 * * column 3, lines 5-14,50-52 * * column 4, lines 1-12 * * figures 1,3 *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.7) A61B G06F G08B H04M
A	US 4 736 196 A (MCMAHON ET AL) 5 April 1988 (1988-04-05) * abstract * * figures 1,2 *	1	
A	US 2002/013717 A1 (ANDO MASAHIRO ET AL) 31 January 2002 (2002-01-31) * abstract * * figures 1-4 *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 148 (E-1522), 11 March 1994 (1994-03-11) & JP 05 327595 A (NEC CORP), 10 December 1993 (1993-12-10) * abstract *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 October 2005	Pohl, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 10 5609

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-10-2005

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6072392 A	06-06-2000	AU 5334599 A	06-03-2000
		WO 0010145 A1	24-02-2000
US 2003069714 A1	10-04-2003	NONE	
US 5982285 A	09-11-1999	AU 3995599 A	29-11-1999
		CA 2332794 A1	18-11-1999
		EP 1101211 A2	23-05-2001
		WO 9959041 A2	18-11-1999
US 4736196 A	05-04-1988	NONE	
US 2002013717 A1	31-01-2002	JP 2002238877 A	27-08-2002
JP 05327595 A	10-12-1993	JP 2765352 B2	11-06-1998

EPO FORM P0459

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

专利名称(译)	检测其从佩戴者身上移除的个人安全装置		
公开(公告)号	EP1615187A1	公开(公告)日	2006-01-11
申请号	EP2005105609	申请日	2005-06-23
[标]申请(专利权)人(译)	IST INT安全TECH		
申请(专利权)人(译)	IST国际安全技术OY		
当前申请(专利权)人(译)	VIVAGO OY		
[标]发明人	SARELA ANTTI MYLLYMAKI MARKO		
发明人	SÄRELÄ, ANTTI MYLLYMÄKI, MARKO		
IPC分类号	G08B25/01 G06F19/00 A61B5/00 G08B21/02 H04M1/725 H04M11/04		
CPC分类号	H04M11/04 A61B5/002 A61B5/0022 A61B5/681 G08B21/0211 G08B21/0286 G08B21/0288 G08B25/016 G16H40/67 H04M1/72536		
代理机构(译)	雷金格尔公司		
优先权	2004005266 2004-07-06 FI		
外部链接	Espacenet		

摘要(译)

安全装置系统和数据终端（6）技术领装置（1）。可穿戴设备（1）具有关于附着到佩戴者的设备的基于测量的识别，所述识别被处理用于状态数据。数据终端（6）具有用户界面，用于以图形方式显示测量的状态数据。

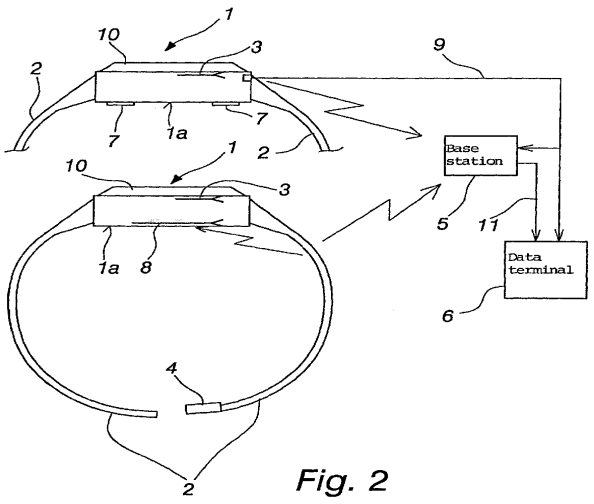

Fig. 2