

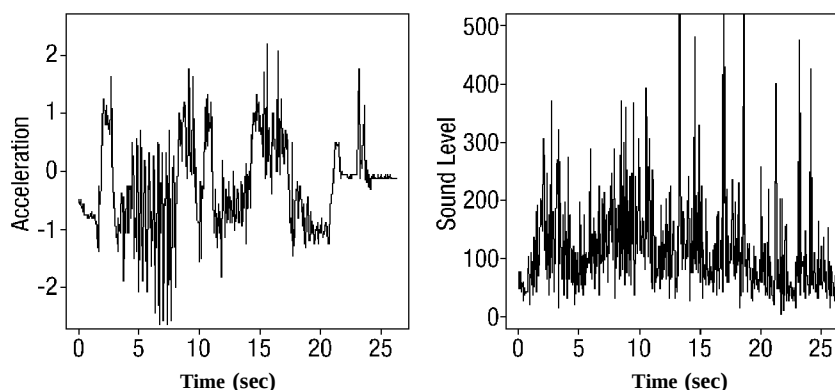


- (51) **International Patent Classification:**
G06Q 30/02 (2012.01) G08B 21/24 (2006.01)
G06Q 50/22 (2012.01)
- (21) **International Application Number:**
PCT/EP2012/074700
- (22) **International Filing Date:**
6 December 2012 (06.12.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
11192970.9 12 December 2011 (12.12.2011) EP
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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

[Continued on next page]

(54) **Title:** SOAP BAR USAGE MONITORING

Fig. 1b



(57) **Abstract:** The invention provides a system suitable for monitoring usage of a soap bar, the system comprising: (a) a soap bar, (b) a programmable data logger which is positioned in the soap bar, the data logger incorporating a motionsensor, a sound sensor, a data store for the logging of data and switching means for triggering the operation of the sound sensor in response to initial signals of soap motion generated by the motionsensor, and (c) a data analysis device which is adapted to analyse data transmitted or acquired from the system to provide information about soap bar usage; in which the duration of data logging is controllable in response to the signals received from the motionsensor and the sound sensor respectively.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, **Published:**
ML, MR, NE, SN, TD, TG).

— *with international search report (Art. 21(3))*

SOAP BAR USAGE MONITORING

Field of the Invention

5 The present invention relates to soap bar usage monitoring.

Background of the Invention and Prior Art

10 The World Health Organisation (WHO) estimates that diarrhoea and respiratory infections are responsible for two-thirds of child deaths. The vast majority of child mortality occurs among the world's poorest populations in low- and middle-income countries.

15 Contamination of surfaces such as hands plays a key role in the spread of diarrhoeal pathogens and some respiratory infections. Appropriate use of soaps and surfactants for improving overall cleanliness would be an effective intervention for prevention, as opposed to treatment, of these infectious diseases. Soap does not necessarily kill germs, but helps to wash them away by improving wettability, reducing their numbers to below the critical infectious dose.

20 Recent research has shown that washing hands with soap at critical moments (particularly after contact with human excreta and before handling food) can cut diarrhoea risk by almost half. Another recent study indicates that hand washing with soap has the potential to reduce respiratory infections by about a third.

25 However, hand washing with soap is not common, though practice varies from country to country. The main reason given why rates of hand washing with soap are so low is that it is simply not a habit. The widely held belief is that if hands look clean, they are clean.

30 The food services and healthcare industries have developed various systems intended to address the problem of insufficient hand washing. Such systems

typically involve complex hardware and elaborate electronics for sensing and monitoring the hand washing process. Therefore they are not suitable for use in a domestic setting by low-income consumers. Moreover they do not address the issue of educating consumers in the long term. Behaviour change and interventions
5 to evoke change are essential to achieve this.

The ability to monitor various aspects of consumers' existing behaviour is key to developing effective intervention strategies and evoking behaviour change. What is needed is reliable, objective information about soap usage, in large populations.
10 This enables the quantification of baseline soap usage, and therefore the effect of interventions.

The present inventors have found that usage of a soap bar can be conveniently and unobtrusively monitored by embedding a logger device incorporating a particular
15 combination of sensors into the soap bar.

Combining information from the sensors enables reduced recording of false events, leading to reduced energy consumption, lower power and memory requirements, greater device efficiency and greater ease of data analysis. This is especially
20 advantageous in consumer behaviour analysis settings, where data capture may be required over prolonged periods of time.

Such devices have improved simplicity and robustness which makes them practical to deploy over large populations.
25

Also, small low power devices are less likely to interfere with normal consumer activity, so the data collected is more representative of real behaviour.

Summary of the Invention

30 The invention provides a system suitable for monitoring usage of a soap bar, the system comprising:

(a) a soap bar,

(b) a programmable data logger which is positioned in the soap bar, the data logger
5 incorporating a motion sensor, a sound sensor, a data store for the logging of data
and switching means for triggering the operation of the sound sensor in response to
initial signals of soap motion generated by the motion sensor,

and

10 (c) a data analysis device which is adapted to analyse data transmitted or acquired
from the system to provide information about soap bar usage;

in which the duration of data logging is controllable in response to the signals
15 received from the motion sensor and the sound sensor respectively.

The invention also provides a method for monitoring usage of a soap bar, including
the steps of:

20 (a) acquiring data from a programmable data logger which is positioned in the soap
bar, the data logger incorporating a motion sensor, a sound sensor, a data store for
the logging of data and switching means for triggering the operation of the sound
sensor in response to initial signals of soap motion generated by the motion sensor,

25 and

(b) analysing the data so acquired to provide information about soap bar usage;

characterised in that the operation of the sound sensor is triggered in response to
30 initial signals of soap bar motion generated by the motion sensor, and in that the
duration of data logging is controllable in response to the signals received from the
motion sensor and the sound sensor respectively.

Detailed Description of the Invention

In the system and method of the invention, a programmable data logger is
5 positioned in a soap bar. Generally the programmable data logger is at least
partially embedded in the soap bar, for example in a hollow or cavity provided in the
soap bar. Preferably the programmable data logger is fully embedded in the soap
bar. In this way, consumer perceptibility (and therefore obtrusiveness) of the logger
is minimised. The inventors have observed, unexpectedly, that the performance
10 and functionality of the logger is not adversely affected to any significant extent in
this environment.

The term "bar" in the context of the present invention generally means a solid unit of
shape and size acceptable for use by human hands. In general, the bar will weigh
15 between 70 and 250 g and have physical dimensions in excess of several cm in at
least one dimension.

The bar will generally be of a hardness typical of toilet soaps (often characterised
by the term "soft solid"). The hardness of a toilet soap bar may be expressed, for
20 example, in "hardness units," which may be measured by a Penetrometer at room
temperature (25°C). Each hardness unit is 1/10 mm. The hardness is represented
by the depth travelled in 15 seconds into the bar by an ASTM D-1321 needle
weighed down by a 50 gram weight. Three readings on an approximately 24-hour
old bar are averaged. Acceptable toilet soap hardnesses usually range from 30 to
25 100 hardness units, preferably from 40 to about 75 units.

The term "soap" in the context of the present invention is intended to encompass
any cleansing composition which removes soil from human skin and is suitable for
application to the human body.

30

Accordingly a "soap bar" in the context of this invention will typically include one or more surfactants, and various additives and other optional ingredients as described further below.

5 Surfactants provide lather and assist in the removal of soil and germs. Typically the surfactants are selected from anionic surfactants such as fatty acid soaps, synthetic anionic detergents, and mixtures thereof. By "fatty acid soap" is meant alkali metal or alkanolammonium salts of aliphatic alkane- or alkene monocarboxylic acids.

10

Examples of synthetic anionic detergents include the alkyl sulphates, alkyl ether sulphates, alkaryl sulphonates, alkanoyl isethionates, alkyl succinates, alkyl sulphosuccinates, alkyl ether sulphosuccinates, N-alkyl sarcosinates, alkyl phosphates, alkyl ether phosphates, and alkyl ether carboxylic acids and salts thereof, especially their sodium, magnesium, ammonium and mono-, di- and triethanolamine salts. The alkyl and acyl groups generally contain from 8 to 18, preferably from 10 to 16 carbon atoms and may be unsaturated. The alkyl ether sulphates, alkyl ether sulphosuccinates, alkyl ether phosphates and alkyl ether carboxylic acids and salts thereof may contain from 1 to 20 ethylene oxide or

15

20 propylene oxide units per molecule.

Other classes of surfactant (such as nonionic, cationic or amphoteric surfactants and mixtures thereof) may also be included to boost bar properties such as foaming and/or skin mildness.

25

The total amount of surfactant(s) in the soap bar will usually range from about 20wt% to about 99wt%, preferably from about 30wt% to about 95wt%, more preferably from about 40wt% to about 90wt%, by total weight of surfactant based on the total weight of the soap bar.

30

A typical soap bar is based on fatty acid soaps (i.e. alkali metal or alkanolammonium salts of aliphatic alkane- or alkene monocarboxylic acids). A

typical soap bar comprises from 70 to 85wt% of fatty acid soaps (by total weight fatty acid soap based on the total weight of the soap bar). In general sodium salts are used, although occasionally, 1 to 30wt% potassium or triethanolamine salts (by weight based on the total weight of the soap bar) are included in the formulation to increase the solubility of the soap and, hence, the bar's lathering properties.

Soap performance can be controlled through the proper blending of oils and fats to specific ratios, and the formation of the proper phase and colloidal structure. A typical blend is (a) tallow and/or palm oil with (b) coconut and/or palm kernel oil, generally in a ratio of (a):(b) between 85:15 and 50:50. Many soaps also contain harder oils such as palm stearines or softer oils such as soya bean.

Additionally, soap bars typically contain between 8 and 20wt% water, 0.5 to 1wt% salt (such as sodium chloride) and low levels (less than 5wt%) of glycerol. Both salt and glycerol modify the processability of soap during milling and plodding, as well as being carryover ingredients from the manufacture of the base soap.

Also, there are a variety of additives that may optionally be formulated into soap bars to provide additional consumer benefits or modify the performance of the products. Examples include free fatty acids, opacifiers (such as titanium dioxide and the like), fluorescers, dyes, chelants, antioxidants, lanolin, vitamin E, aloe vera gel, mineral oil, baking soda, inert materials (such as oatmeal, dextrin, starch, wax, talc and the like), cationic polymers based on natural materials such as cellulose, guar gums, and proteins, and skin antimicrobial agents (such as trichlorocarbanalide and trichlorohydroxydiphenyl ether).

In order that it is not adversely affected by moisture or direct water contact, the programmable data logger will generally be water-resistant. For optimum performance in the bathroom environment, the programmable data logger will most preferably be waterproof. To achieve this the programmable data logger may suitably be encapsulated with a water-impervious material to provide an Ingress Protection (IP) rating of IP67. Ingress Protection (IP) ratings are developed by the

European Committee for Electro Technical Standardization (NEMA IEC 60529 Degrees of Protection Provided by Enclosures - IP Code), specifying the environmental protection the enclosure provides. A suitable encapsulation technique is injection moulding using a low pressure and low temperature technique and material.

The programmable data logger generally incorporates a power source, which is typically a DC power source such as a small (e.g. 3V) battery. To prolong battery life, a capacitor may be included. Alternatively the programmable data logger may be at least in part solar powered. As described above, the programmable data logger is most preferably encapsulated with a water-impervious material. In this case, it may be charged by induction coils provided in the programmable data logger and in a base unit.

The sound sensor incorporated in the programmable data logger is adapted to detect sounds associated with the use of the soap bar and to generate signals corresponding to the detected sounds. Typically, the sound sensor is an audio transducer, such as a microphone. Suitable microphones include contact microphones, otherwise known as pickup or piezo (piezo-electric) microphones, which are designed to transmit audio vibrations through solid objects.

Typically, the sound and/or vibrations which are detected by the sound sensor during use of the soap bar are filtered through a hardware filter on-board the programmable data logger, which is designed to capture the portion of the signal within a specified bandwidth which is indicative of actual washing events such as hand washing.

The motion sensor incorporated in the programmable data logger is adapted to detect motion of the soap bar and to generate signals corresponding to the detected motion. Typically, the motion sensor is an accelerometer capable of sensing accelerations along one or more axes. The accelerometer may be capable of sensing accelerations along three orthogonal axes. Any suitable tri-

axial accelerometer could be used or alternatively, two 2-axis ones mounted at right angles capable of sensing 3-dimensional acceleration data. Alternatively any other suitable motion sensor may be used. The motion sensor may be analogue or digital.

5

The data store incorporated in the programmable data logger preferably incorporates erasable non-volatile memory. Erasable (rewritable) memory allows re-use of the data logger. Non-volatile memory is preferable because this means the memory is protected in case of a loss of power (e.g. in the case of battery powered devices, when the battery loses power).

10

The data logger is programmable, and typically contains a programmable computing device, such as a microprocessor (e.g. a microcontroller) which is capable of reading and executing program instructions to control the various components within the soap bar usage monitoring system of the invention.

15

In a typical soap bar usage monitoring method using the system of the invention, the programmable data logger is first connected to a computer (typically a PC or similar). Programming will provide key operational parameters such as the activation and the duration of the data logging process.

20

The programmed data logger is then positioned in the bar of soap as described above.

25

The programmable data logger incorporates a motion sensor which is adapted to detect initial signals corresponding to soap bar motion. When such initial signals are detected, switching means trigger the operation of the sound sensor. Tilt switches are a preferred switching means in the context of the present invention in view of their small size, simple construction and low power consumption.

30

The data logger checks for motion of the soap bar, indicated by signals generated by the motion sensor (typically an accelerometer or similar). Data is also acquired

from the sound sensor, activated by the initial detection of soap bar motion as described above.

5 The duration of data logging is controllable in response to the signals received from the motion sensor and the sound sensor respectively.

10 The inventors have found that the data acquired from the sound sensor provides a surprisingly reliable means of indicating whether an actual washing event (such as hand washing) is taking place, as opposed to merely shaking or moving the soap bar without contacting the skin (a false event).

Accordingly, in the system of the invention the data logger will typically be programmed so that data logging is started in response to the signals received from the motion sensor and the sound sensor. The data logger will also typically be
15 programmed so that data logging only takes place when the signals received from the sound sensor and the signals received from the motion sensor are each registered above pre-defined thresholds of duration or intensity. In this way the system of the invention is able to operate in an "active data capture" mode for capturing the activity of interest, but is also able to revert to a "low power mode" at
20 other times. This enables reduced recording of false events, leading to reduced energy consumption, lower power and memory requirements, greater device efficiency and greater ease of data analysis.

25 The data acquired by the system of the invention is analysed by a data analysis device to provide information about soap bar usage.

Typically, the data acquired by the system of the invention is downloaded to a remote data analysis device such as a computing device (e.g. a PC). Alternatively the data may be transmitted to the data analysis device by cellular telephony or
30 wireless LAN technology, preferably "Wi-Fi" (wireless fidelity) enabling easy, fast communication via internet.

As described above, the programmable data logger is most preferably encapsulated with a water-impervious material. In this case, data reading may suitably be via IR.

- 5 The analysis can provide information about various aspects of soap bar usage, such as the duration of individual washing (e.g. hand washing) events, the frequency of individual washing (e.g. hand washing) events per day or a combination of the above.
- 10 A particular advantage of the system of the invention is its ability to identify different individual washing (e.g. hand washing) events, even when they are closely spaced apart in time, such as successive usages by family members.

- Furthermore, data analysis can take place conveniently e.g. in a laboratory many
- 15 miles away with minimal interference in the consumers' life.

EXAMPLE

5 A programmable data logger as described above, incorporating *inter alia* a sound sensor (microphone) and a motion sensor (accelerometer), was embedded into a soap bar.

Two different events were recorded as follows:

- 10 (a) consumer walks with the soap, no actual washing usage
(b) consumer washes hands with the soap

For (a): The appended **Figure 1a** illustrates the acceleration (left panel) and sound level (right panel) as measured by the embedded data logger.

15

For (b): The appended **Figure 1b** illustrates the acceleration (left panel) and sound level (right panel) as measured by the embedded data logger.

20 In the case of the false event (a), although there is sizeable variation in the acceleration, the sound level is bounded.

By contrast, in the case of the real event (b), both acceleration and sound signal consistently attain high values, such that this data is correctly identified as a washing event.

25

The sound signal therefore provides an accurate discriminator as to whether an actual washing event is taking place, as opposed to merely moving the soap bar without contacting the skin (a false event).

- 5 Using this information, the system of the invention can be set up to capture only the motion of interest. This is generally achieved by the tuning of hardware filters on board the programmable data logger, and by the design of the software algorithms controlling the data logging process.

CLAIMS

5

1. A system suitable for monitoring usage of a soap bar, the system comprising:

(a) a soap bar,

10

(b) a programmable data logger which is positioned in the soap bar, the data logger incorporating a motion sensor, a sound sensor, a data store for the logging of data and switching means for triggering the operation of the sound sensor in response to initial signals of soap motion generated by the motion sensor,

15

and

(c) a data analysis device which is adapted to analyse data transmitted or acquired from the system to provide information about soap bar usage;

20

in which the duration of data logging is controllable in response to the signals received from the motion sensor and the sound sensor respectively.

25

2. A system according to claim 1, in which the programmable data logger is at least partially embedded in a hollow or cavity provided in the soap bar.

3. A system according to claim 1 or 2, in which the sound sensor is an audio transducer such as a microphone.

4. A system according to any one of claims 1 to 3, in which the switching
5 means is a tilt switch.

5. A system according to any one of claims 1 to 4, in which the data store incorporates erasable non-volatile memory.

10 6. A system according to any one of claims 1 to 5, in which the programmable data logger is programmed so that data logging is started in response to the signals received from the motion sensor and the sound sensor.

15 7. A system according to any one of claims 1 to 6, in which the soap bar comprises from 70 to 85wt% of fatty acid soaps (by total weight fatty acid soap based on the total weight of the soap bar).

8. A method for monitoring usage of a soap bar, including the steps of:

20 (a) acquiring data from a programmable data logger which is positioned in the soap bar, the data logger incorporating a motion sensor, a sound sensor, a data store for the logging of data and switching means for triggering the operation of the sound sensor in response to initial signals of soap motion
25 generated by the motion sensor,

and

(b) analysing the data so acquired to provide information about soap bar usage;

5 characterised in that the operation of the sound sensor is triggered in response to initial signals of soap bar motion generated by the motion sensor, and in that the duration of data logging is controllable in response to the signals received from the motion sensor and the sound sensor respectively.

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Fig. 1a

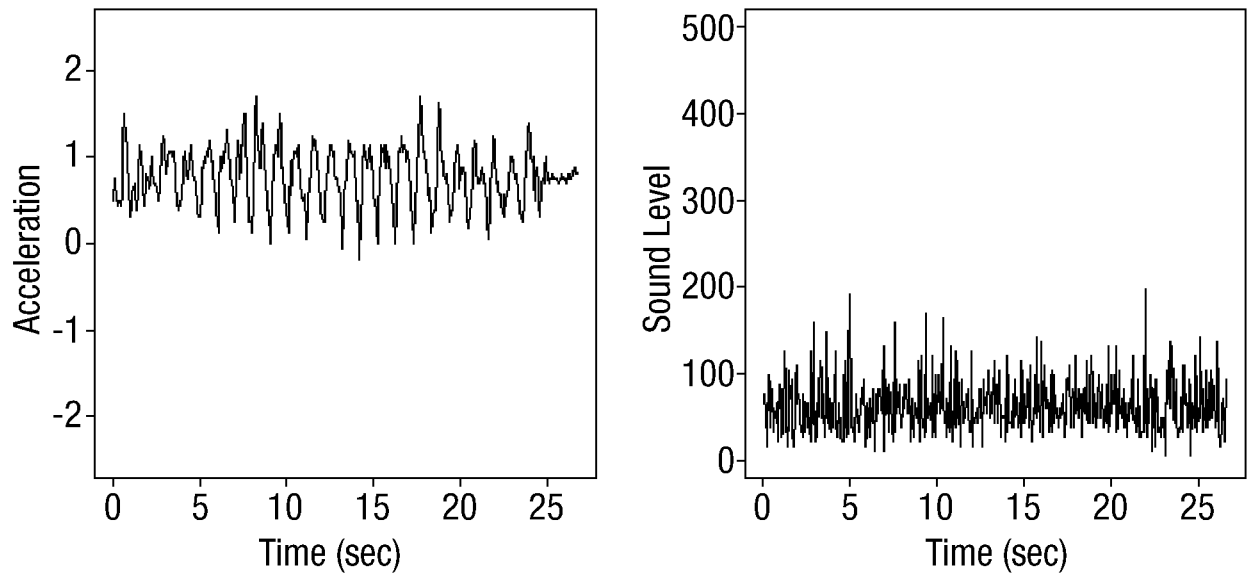
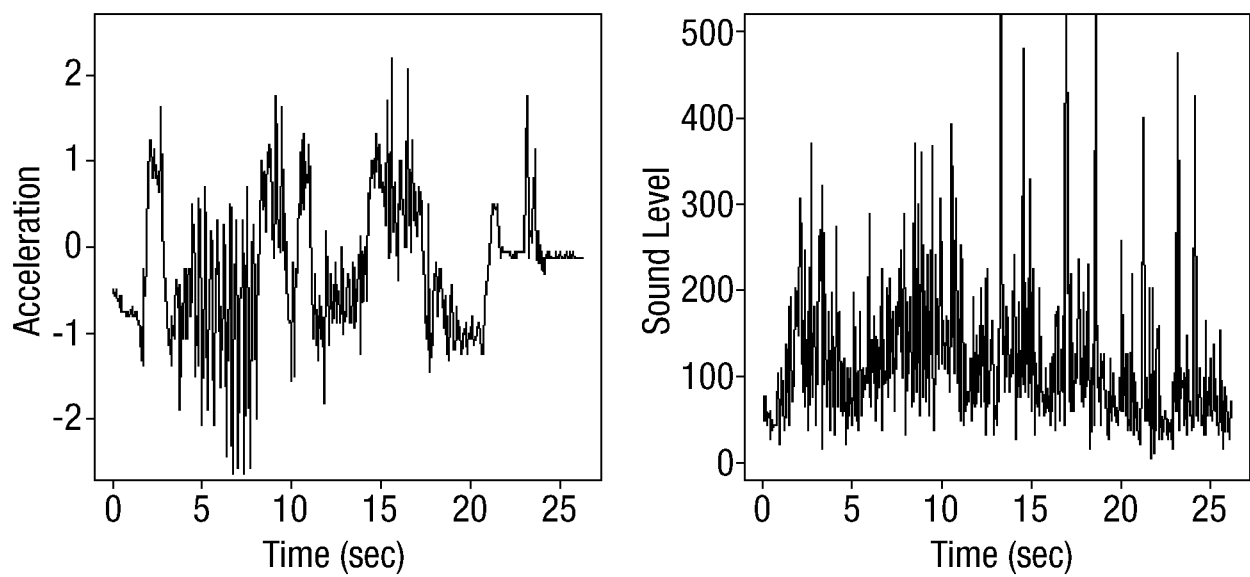


Fig. 1b



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/074700

A. CLASSIFICATION OF SUBJECT MATTER INV. G06Q30/02 G06Q50/22 G08B21/24 ADD.		
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) G08B C11D G06F G06Q G07C		
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 practicable, search terms used) EPO-Internal , WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	wo 2008/058817 AI (UNI LEVER PLC [GB] ; UNI LEVER NV [NL] ; UNI LEVER HINDUSTAN [IN] ; GRUBB SC) 22 May 2008 (2008-05-22) abstract; figure page 3, line 1 - page 6, line 17 page 7, line 6 - page 9, line 10 page 10, line 16 - page 11, line 26 -----	1-8
Y	wo 2010/028320 AI (EGRESSION LLC [US] ; JOHNSON MICHAEL D [US] ; CLARK ROBERT LOUIS [US]) 11 March 2010 (2010-03-11) abstract; figures 1,2 paragraphs [0006] , [0017] , [0023] paragraphs [0033] , [0040] , [0045] - [0046] paragraphs [0050] - [0056] -----	1-8
☐ 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 application or patent 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) "O" 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 "T" 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 6 March 2013		Date of mailing of the international search report 15/03/2013
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Buron , Emmanuel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/074700

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008058817 A1	22-05-2008	EP 2082367 A1	29-07-2009
		WO 2008058817 A1	22-05-2008

WO 2010028320 A1	11-03-2010	US 2010073162 A1	25-03-2010
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