(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 August 2019 (29.08.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/162279 A1

(51) International Patent Classification:
G16H 40/20 (2018.01) *A47K 1/02* (2006.01)

(21) International Application Number:
PCT/EP20 19/054107

(22) International Filing Date:
19 February 2019 (19.02.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
20180264 20 February 2018 (20.02.2018) NO

(71) Applicant: GANTEL PROPERTIES LIMITED [GB/GB]; c/o Line Management Services Limited Hassans - International Law Firm, 57/63 Line Wall Road, Gibraltar Gibraltar (GB).

(72) Inventor: KNOOP, Kjell; Rue Chapuis, 4800 Venders (BE).

(74) Agent: ONSAGERS AS; P. O. Box 1813 Vika, 0123 Oslo (NO).

(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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, SA, 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, ST, 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, TR), OAPI (BF, BJ, CF, CG, Cl, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) **Title:** SYSTEM AND METHOD FOR MONITORING AND PROVIDING GUIDANCE TO HEALTH CARE PROFESSIONALS FOR HYGIENE PURPOSES

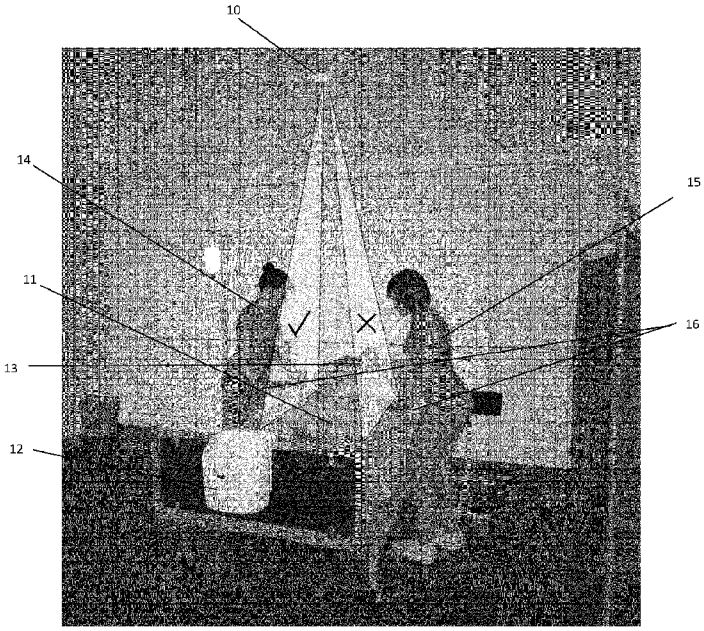

Figure 2

(57) **Abstract:** A system for monitoring and providing guidance to health professionals for hygiene purposes comprises a hygiene area, an identification unit for identifying persons in the hygiene area, a recording unit for recording data representing the presence and movement of the identification unit within the hygiene area and a processing unit for processing data from the recording unit.

WO 2019/162279 A1

[Continued on next page]

Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(H))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

SYSTEM AND METHOD FOR MONITORING AND PROVIDING GUIDANCE TO HEALTH CARE PROFESSIONALS FOR HYGIENE PURPOSES

The invention relates to systems for infection control, quality assurance, follow-up of work and alerts in hospitals, clinics, health institutions and/or other areas that require the maintenance of good hygiene.

BACKGROUND

Dissemination of infection diseases in health institutions is a well-known problem. The reason why infections occur in health institutions are complex. Several elderly and immunosuppressed patients as well as increased levels of antibiotic resistant bacteria make it challenging to reduce the number of infections at health institutions. New travel habits also contribute to increasing the risk of infection. New methods of treatment and care can also increase the risk of infection in patients/those in need of nursing.

The consequences of hospital infections are serious and cost a lot to society. There will be more hospitalization days and need for increased treatment. At the same time, the hospital queues grow as a result of longer hospital stays. In addition, several cases end with permanent invalidity, or in the worst case death. The health service focuses on the problem, but some bacteria have developed or are developing resistance to antibiotics and are therefore difficult to overcome when the infection has first occurred.

There is therefore a need for new technology that focuses on preventive work, quality assurance of work, non-compliance registering/reporting, staff supervision, monitoring and treatment.

It is widely known that the number of infections varies between different departments and health enterprises, because some hospitals have more patients at increased risk of infection, and because hospitals with demanding treatments are more vulnerable. There is therefore a need for technology that makes it possible to uncover weaknesses in existing routines and to improve these routines.

Some existing systems assume that it is satisfactory to wash the hands before entering the patient room. One then forgets that in order to reach the patient, one has to grip the door handle. It has been used by patients, visitors, laundry staff and others. It is therefore not necessarily clean. A much better solution is therefore to carry out a hand wash when standing by the patient's bed.

Some existing systems describe how to perform hand hygiene before contacting the patient.

US 8558660 and US 20161 1791 show examples of such systems.

However, these existing systems have a major weakness. They have ignored the fact that healthcare professionals in the care of patients often have to wash themselves during the patient's care to ensure the hospital's requirements for good hand hygiene. For example, you must wash after being in contact with urine or having cared for an infected wound (unclean area). A wound may be infected during the hospital stay. It is therefore not possible to only use for example RFID technology to determine whether the wound is clean or unclean.

Both patients and visitors are potential carriers of infections, and the same applies to instruments used close to the patients, such as stethoscopes, blood pressure gauges, instruments placed on intravenous stands, etc.

The infection can also be transmitted to the patient via medicines distributed by the patient and via the food served. Many patients are day-care patients and often visit several medical offices etc. during a day. For example, it may be before an admission or in connection with a patient who is in control.

Prior art has several weaknesses. Some of these weaknesses are listed below.

1. Focuses on monitoring employees and reporting deviations to management.

2. Does not include patients / visitors in their methods / solutions.

3. Has no technology / method to alert about infection risk.

4. Has no solution covering both preventive work, guidance during the work, quality assurance, follow-up of work and alerts.

5. Depends on the staff being involved / doing active actions to work, such as the staff making choices and then manually updating the system.

6. Is not designed to find weaknesses in existing routines, which can help reduce the number of infections.

In reports of causes of infections in hospitals, clinics and other health institutions, and how this can be prevented, two factors are pointed out:

1. Too poor hand hygiene among healthcare professionals. A number of reports confirm that healthcare professionals do not wash their hands according to the hospital routines. Both with regard to frequency and thoroughness. (A properly done hand wash with soap and water takes at least 40 seconds + rinse and dry, hand wash done with disinfectant takes about 15 seconds).

2. Too poor cleaning of instruments close to the patient. Instruments close to the patient include stethoscopes, blood pressure gauges, instruments on mobile racks, etc.

The term healthcare professionals means in this document nurses, nursing assistants, doctors, dentists, physiotherapist, micro biologists, etc.

The reports suggest several elements that may be the cause of the factors above. Some of these are:

- Time pressure in the workplace
- Few available cleaning stations
- Use of rings / watches
- Long nails
- Inadequate training
- Lack of knowledge of infectious disease
- Generally little focus on hygiene at the institution in question

It has also been focused on poor hand hygiene among patients / caregivers and visitors, and that this poses a risk of infection.

SHORT DESCRIPTION

The object of the invention is to provide a system, device and method which solves or reduces the problems of known systems.

The object of the invention is achieved by the features of the patent claims.

The invention aims to provide a solution (system and method) that combines various technical units, which together will lead to better hygiene in hospitals or other institutions. The technical solution can be used to monitor and guide employees, patients and visitors. It is also possible to use data from the system to gain experience of how the work is actually carried out, and to use this data source in connection with training of personnel and for general documentation.

The invention is related to hygiene rules for the cleaning of hands and instruments close to the patient at healthcare institutions, as well as general quality assurance of the work of following up patients in hospitals and other types of healthcare facilities and identifying symptoms attributable to infections, but not limited to this.

The new technology can also be used to improve existing routines. One can imagine that data is collected at several departments / hospitals / clinics, often in several cities and countries. By analyzing the collected data, one can form a picture of whether there are factors that affect the number of cases of infection.

In one embodiment, a system for monitoring and providing guidance to healthcare professionals for hygiene purposes comprises a hygiene area, an identification unit for identifying persons within the hygiene area, a recording unit for recording data representing the presence and movement of the identification device within the hygiene area, and a processing unit to process data from the recording unit.

The recording unit may be a radio transmitter / receiver, lidar, radar and / or another type of object identification and tracking device. The recording unit is mounted, for example, in the ceiling above the patient bed, on the wall behind the patient bed or on the bed itself.

In one embodiment of the system, the identification unit is a portable device. The unit may be adapted to attach to a user's clothing / uniform, e.g. in the form of a pin, or connected to a safety pin or other type of fastener, or it may be adapted to be carried at or near a user's hand. For example, the identification unit is integrated into a nameplate, in an identification bracelet or embedded or otherwise integrated into clothing, uniform or similar. In one embodiment, the identification unit comprises a radio transmitter adapted to output at least one radio response signal in response to reception of at least one radio polling signal and the recording unit comprises at least one radio transmitter and receiver. The identification unit may comprise or be an RFID transponder.

Lidar is an optical remote sensing technique used for rapid measurement of physical object position. By measuring the time difference or changes in the wave phase between an emitted laser signal and a reflected light, the distance to and other properties of objects can be calculated.

Radar (an Acronym for Radio Detection And Ranging) is a device that uses radio waves to measure direction and distance to other objects. The direction is determined by the antenna which is very directional, that is, it transmits its signal into a narrow beam and receives only signals from the same direction.

In the cases where the recording unit is a lidar, radar, or other object identifier, it may constitute both the identification unit and the recording unit.

One or more Lidar / Radar or equivalent unit(s) are placed eg. in the ceiling and / or on the wall of the patient room or directly on the patient bed. The lidar is connected to the processing unit which includes a software program.

The lidar enables the system to identify the bed and distinguish it from the rest of the furniture, which is located in the patient room, and from the rest of the environment. The lidar can draw an electronic map of the patient room with all the accessories and record, identify and distinguish between different movements that take place in the lidar's coverage area.

Along with software, it is possible to determine whether, for example. a hand moves over the edge of the bed, and if the hand comes from the bed (ie belongs to the patient), or if someone stretches his hand from the outside and into the bed zone (for example, a health worker or a visitor standing close to the bed).

Furthermore, it is possible to teach the software various movements / operations, and to distinguish between these movements / operations. This can for example be done by specialist personnel performing a special work operation registered by the lidar. The registrations are stored in the software. When professional staff again perform the same actions, the software will recognize these and separate the different work operations from each other.

By an operation is meant. e.g. use of stethoscope, replacement of catheter or care of wounds and more. Lidar / radar can be used for this purpose, but other units that can identify objects can also be used.

In one embodiment, the system comprises at least three radio transmitters configured to transmit at least one radio interrogation signal and receive at least one radio response signal.

The processing unit is in one embodiment connected with the radio transmitters and is adapted to process the received signals to identify the position of the identification unit. The processing unit may, for example, be adapted to compare received data from the recording unit with mathematical models stored in a memory unit connected to the processing unit. The system can, by means of the processing unit, identify, distinguish and recognize persons, objects and movements in the hygiene area based on the signals from the recording unit. These signals, as described, may be signals from a radio transmitter, e.g., an RFID transponder or other type of radio unit, from a lidar or radar, or other suitable means. The processing unit may also be adapted, based on the comparison, to classify the status of the identification unit to clean / non-clean.

In one embodiment, the system comprises an indicator unit adapted to convey the status of the identification unit, e.g. to send out light or sound. The processing unit may also be adapted to provide a guidance signal, and this guidance signal may be used by the indicator unit or other device to provide visual, audible or tactile guidance to users.

Systems may also include a pressure sensor capable of detecting the presence of a patient in a bed. The sensor may be connected to the processing unit and the signal from the sensor may be used to activate or deactivate the system. The system may also include a light sensor that detects light in the room. The signal from the light sensor may also be used to activate or deactivate the system.

The system may include a central computer and means for communicating between the processing unit and the central computer.

The system comprises in one embodiment a station for cleaning. The station for cleaning can e.g. be a traditional wash basin or another type of station for cleaning hands or instruments to be used on or near patients.

Washing hands is a topic of the World Health Organization. The organization focuses not only on washing, but also on how the wash of hands is to be carried out.

The invention therefore also comprises a station for cleaning which is constituted by a device for cleaning hands and / or instruments.

This device is more efficient than:

1. The traditional sink/basin.

2. Getting a disinfectant on your hands via a dispenser.

The device comprises, in one embodiment, a cleaning agent container and at least one chamber adapted to receive hands or objects to be cleaned. The chamber(s) includes nozzles for transferring cleaning agent from containers to the chamber and to provide a flow of cleaning agent into the chamber.

The cleaning agent can e.g. be a disinfectant, soap and water or a combination of these. Other cleaning agents can also be used, either alone or in combination with other agents. In one embodiment, the device includes an air inlet, and the nozzles are adapted to mix the cleaning agent with air to optimize the spreading of detergent over the surfaces to be cleaned on hands and / or other objects.

The device comprises, in one embodiment, at least one sensor for detecting when the hands or the object to be cleaned are correctly positioned in the chamber and a control unit connected to the nozzle(s) and adapted to activate the nozzles(s) when it is detected that the hands or the article as being to be cleaned is properly located in the chamber and deactivate the nozzle(s) when the hands or the object to be cleaned are removed from the chamber. The device may also include an antenna capable of communicating with RFID transponders and with a processing unit.

In one embodiment, the device is designed to include tight walls and a front cover. A sensor may be provided on the outside of the device or in the vicinity thereof to detect the presence of a person in front of the device. The device may include a control device for opening the lid when the sensor detects presence.

The device may also include a UV source which irradiates the basin internally when not in use.

In practice, this can e.g. mean that the traditional basin is replaced with a new type of basin where one can choose between regular soap washing, or to clean the hands using a disinfectant sprayed on the hands through nozzles placed in a chamber.

A cleaning unit with disinfecting chamber can be mounted on each bed, which makes it easy to clean the hands by means of disinfectant.

Using the system described above, one can check that the hospital's internal procedures for hand hygiene and washing of patient-close instruments are observed. If the routine is not followed, it is possible to tell the person who does not observe the routine about the deviation before physical contact with the patient occurs. The person who breaks the work routines can then be guided so that the hygiene requirements are again satisfied, without the patient being exposed to the risk of infection. The method is automatic and requires no involvement from the health personnel.

Examples of system usage:

Health personnel / staff at the patient bed.

The guidance may e.g. be given by showing the following at the edge of the bed in front of the health care professional:

Red light if hand hygiene is not in accordance with hospital regulations. The light will remain on until the person has moved away from the bed.

Green light, if hand hygiene is in accordance with hospital regulations. The light will automatically turn off after a few seconds.

Healthcare professionals / employees who are going to retrieve medicines.

Healthcare professionals who are required to find medication for the patients must wash themselves in a disinfection chamber located close to the door where the medicines are stored. The disinfection chamber reads the identification unit of the health care professional and sends the status "clean" to the locking mechanism on the door. To be able to open the door, one must use the hospital keys and have the status as "clean".

Health personnel / employees who will use instruments close to the patient.

The guidance is given by showing the following at the edge of the bed in front of the health personnel:

Red light if the instrument is not cleaned according to the hospital's routines. The light will remain on until the instrument is removed from the bed.

Green light, if the instrument is cleaned according to the hospital's routines. The light will turn off automatically after a few seconds.

Health professionals / staff. Use of RFID transponders for employees.

Here you can imagine several different options:

1. You can equip all employees with a personal RFID transponder. It will then be possible to track and identify all work operations that have been carried out and to link this information to who has performed the work, along with the time and place of the incident. At the same time, the control program can record how the individual performs their work tasks and measure it against a standard / model for how the health institution wants the tasks to be performed.

The hospital's procedures for hand hygiene and cleaning of patient-close instruments are one of many work tasks that can be observed by the new system.

The system can continuously alert the person carrying the RFID transponder to any deviations that arise in connection with the exercise of the various work operations. The data can be stored and used as documentation or in connection with training.

2. If one does not want the possibility that the individual health worker can be identified, the health personnel can use an RFID transponder that is exchanged after each working day. One then achieves the same benefits as under point 1), but with the difference that it is not possible to identify the health personnel / the employees.

3. All RFID transponders can have the same ID. It will then not be possible to identify the personnel. The chips therefore need not be replaced, but the system can still collect information about the different work routines and how they are performed.

4. One can base the information retrieval on the data from the lidar alone and not use any kind of person ID associated with individuals.

Option 1 gives the employer an opportunity to monitor the employees. In many countries, this is prohibited by law. Then you can use option 2, 3 or 4, and a server that does not store information about time and patient room / department. It is then not possible to link activities to people.

The patient. (Use of RFID transponder for patients).

Preventive:

Visiting rooms, dining rooms and TV lounge are all examples of rooms with heavy traffic. It is therefore difficult to guarantee that these rooms are clean at all times. Patients that have been out of bed, for example in the visiting room, in the dining

room or on the TV lounge, should therefore wash their hands before going to bed again.

All patients are today equipped with a bracelet. The patient's name, blood type, etc. are written on the bracelet. The purpose of the bracelet is that the hospital staff should be able to identify the patient, if the person loses consciousness or the like. In one embodiment, an RFID transponder is inserted into this bracelet or other suitable location carried by the patient.

To check that the patients wash their hands after visiting places as mentioned above, the system can detect if the patient leaves the bed, if he has been outside the patient room and later returned. This registration can be carried out in several ways, such as:

a. Via signal from a pressure sensor located in the bed.

b. By the lidar drawing an electronic image of the object and by a machine recognition unit comparing the data with the movements of a person standing up from the bed and / or lying down in bed or being elsewhere in the room.

c. Using communication between antennas located at the door / in bed and RFID transponders carried by the patient in the bracelet.

d. Using a combination of one or more of the above methods.

When the patient is back in bed after being outside the patient's room, the system will check whether the patient has visited the basin inside the patient room or on the patient's toilet. This can be done, for example, by checking that the patient's RFID transponder has been registered by the basin. If not, a red light will light up, so the patient can see this when lying in bed. This should remind the patient that he must wash his hands, at the same time as the specialists will register this deviation.

Follow-up and notification of symptoms of blood poisoning.

The patient's bracelet may be provided with additional sensors, such as one or more of temperature sensor, heart rate sensor, and blood pressure sensor. Using the RFID transponder, the system can continuously monitor the patient's temperature, heart rate and blood pressure. The system can compare the data and send out an alarm if given threshold values are exceeded. The alarm can, for example. go directly to the health worker on duty and / or appear on a tableau. In addition, a blue light will light over the bed of the acutely sickening patient.

The technical solution can also alert if a patient suddenly experiences alarming symptoms, eg. symptoms compatible with e.g. blood poisoning.

Typical symptoms of blood poisoning are that the patient:

- Gets very quickly unwell
- High heart rate
- High fever
- Freezes and shivers
- Mental abilities are be impaired
- Gets apathetic and distant and difficult to make contact with

Visitor. (Use of RFID transponders for visitors).

Visitors may in some cases be a risk of infection. It is possible to equip visitors with an RFID transponder so that visitors can also be guided by the system. It is also possible for the system to separate visitors who do not use RFID transponders from hospital staff using RFID transponders, because the lidar may detect movements while the RFID reader does not detect movements within the antenna coverage area.

Washing / disinfection chamber used as part of a system for quality assurance in hospitals, clinics, doctor's office, health care institutions and more.

The disinfectant is sprayed onto the hands by means of nozzles located in the chamber. The fluid can be forced out through the nozzles together with air to control the effect. The location of the nozzles can be designed so that the disinfectant is spread over the entire surface of the hand, between the fingers and under the nails. The chamber can also be adapted to contribute to this. To improve the effect of cleaning, the nozzles can e.g. be of a rotating type. Some types of detergent have the greatest effect if the particles are crushed and settle as a mist on the surface to be cleaned. This can be achieved by e.g. to use special nozzles. Other cleaning agents work best as foam. This effect can be achieved by e.g. to mix air and detergent.

The nozzles are positioned so that the flow also strikes between the fingers and under the nails. These are places that by experience has not had enough focus during washing. The washing unit can recognize various objects (hand, stethoscope) that are inserted into the chamber. The cleaning can therefore be performed according to different programs.

One can also imagine a container with disinfectant/basin placed on the bed, in the corridor and elsewhere in the hospital, to obtain increased accessibility. All the basins can communicate with the system.

The lidar / recognition unit transmits the information to the system and the machine learning unit. The machine learning unit is software that reads and stores the motions for typical operations, and compares them to models that are already stored in the memory. Such operations can be, for example, replacement of catheter, change of bedding, care of wounds, intake of medication and water / food, use of stethoscope and more. In this way, the system can identify and point out nonconformities, guide and also be used in the training of health personnel and other employees.

Clean / unclean places on the body.

It is well known that health care professionals are required to wash their hands before starting to examine/treat or care for a patient and when switching between patients. It is also relatively easy to remember and control.

Adhering to the hospital routines becomes more and more difficult when you also have to remember to wash your hands every time you move from an unclean area of the body to a clean area of the body.

By unclean area of the body, it is meant for example parts of the body where body fluid (urine, faeces, blood, saliva) exits the body, but wounds may also develop into impure/unclean areas (infection of the wound) during hospitalization.

Lidar / radar draws a picture of the room with all the objects in it, all movements in the bed and in the immediate vicinity of the bed. The image is continuously updated and interpreted by the machine learning unit (software). The machine learning unit compares the data that comes from the lidar, with models added to the program memory.

That way, the program can determine if you are working in a clean or unclean area of the body.

When the machine learning program (artificial intelligence) discovers that actions are defined as actions in the "unclean area" of the body, the system will ensure that the person performing the work washes his hands when the health worker in question moves to a "clean" area of the body.

Bed.

It is desirable to know whether the patient is in bed, in the patient room or outside the patient room.

It can for example be solved in the following ways:

a. A pressure sensor can be placed in the bed that detects when the patient is in bed / not in bed.

b. One or more lidar / radar located in the room or directly on the bed can detect whether the patient is in bed or elsewhere in the room.

c. A RFID antenna mounted in the door will detect when the patient leaves the room because the patient's bracelet contains an RFID transponder.

d. The bed RFID antenna will detect when the patient arrives / leaves the bed because the patient's bracelet contains an RFID transponder.

Instruments close to the patient. (Mobile instruments on trinod/stand.)

Instruments close to the patient should be cleaned according to the hospital procedure. An RFID transponder mounted on the stand itself may alert the system when the mobile instrument enters a patient room, and if it is moved from bed to bed.

This can be done, for example, by placing an antenna at the door into the patient room. Each time the instrument passes the antenna, the system and the RFID transponder communicate with each other via the antenna. If the instrument is moved between two beds, the lidar will recognize the object and send the message to the system.

A red light will appear on the instrument in the case of violations of the cleaning routine.

It is especially important that the tablet and screen are cleaned. This can for example be controlled by the following methods: Use of pressure sensors that are attached to selected locations on the tablet and screen, and/or light sensitive sensors located at selected locations on the tablet and screen. When the instrument is washed, the pressure sensors will be touched and the photosensitive sensors will be covered by the wiping cloth briefly. The sensors will then send a signal to the system.

If the system does not receive the expected signal from the sensors, a red light will be turned on which reaches the bed.

Many patients rely on various intravenous fluids. The bags with the various intravenous fluids are often hung on a mobile stand, often called (intravenous rack). Some of the patients are well enough to receive visits, watch TV and make their own purchases in the hospital's kiosk. Without understanding the consequences, the patients make their way to the visiting room, TV room or kiosk with the intravenous stand in tow. When they return to the patient room, they put out the stand next to the bed without it being cleaned. In a busy day, it is also not certain that the hospital's staff register the incident. But the lidar / radar will record that the patient has taken the stand outside the patient room. If this happens, the system will notify

the event. Such a warning can happen in several ways. For example can the system draw a picture of an intravenous rack on the wall behind the patient, or directly on the bed. It is also possible to write what is the deviation.

Stethoscope.

The stethoscope should be cleaned after each use.

In one embodiment, the stethoscope is equipped with an RFID transponder which communicates with the system via RFID antenna, which is located in the ceiling or in the bed. The system can check if the RFID transponder has recently been detected by the basin. Based on this information, the system can send a green light (ok) or a red light (must be washed) down on the bed.

Corresponding actions may be done with other patient-close instruments such as blood pressure monitors.

It is also possible to use lidar / radar or another type of recognition device instead of RFID technology.

Medicine cabinet.

Healthcare professionals should not be in direct contact with the medicine which is distributed to patients. This may still happen. It is therefore important that those who prepare the medicine for the patients are clean on their hands. In practice, this means that they must have washed their hands immediately before retrieving the medicine from the medicine cabinet.

In order to make sure that this is done, it can for example be installed a basin / chamber for disinfectant in the immediate vicinity of the medicine cabinet. The RFID transponder carried by the hospital worker will be recorded by the basin / chamber. To open the door of the medicine cabinet, one must identify with the correct ID. It will only be possible to open the medicine door if:

The ID on the chip is in accordance with the person having access to the medicine cabinet and the ID is identical to the ID that the basin / chamber has registered.

Follow-up of patients.

In many cases, patients require follow-up beyond the traditional, such as need for washing, food, toilet visits, etc. This may include physiotherapy treatment, frequent observations, etc.

It is possible for the hospital administration to enter a program (care, inspection, adapted treatment), which is adapted to the individual patient. The administration

can enter this information into the system. Using the recognition unit, it is possible to check that the patient actually receives the prescribed treatment / follow-up. Deviations can be reported electronically and continuously to the administration or to others at the hospital / health institution.

Quality assurance of the work.

The machine learning unit has many different types of work operations stored in the memory. The program interprets all the data coming from the recognition unit continuously, comparing these data with the operations stored in the memory. The hospital's management can also include special needs that the individual patient may have in the memory. The system can then monitor that the patient receives the treatment he or she is intended to receive.

In cases where a deviation is recorded in how the work itself is performed, the system will send out a yellow light that hits the bed. For example, the light may have a shape as a question mark. This will make the employees reflect on whether the work they perform is in accordance with the patient's needs and the hospital's quality standard.

Documentation and use of collected data.

The system can include a software and memory that can log and store all the activities on a local or central server, if the hospital subsequently needs to be able to present documentation that the hygiene and the tasks performed have been in accordance with the guidelines.

Imagine for example that a physiotherapist has created a training program for a bedridden patient. It often happens that the physiotherapist instructs the patient on how the exercise should be performed, starts the training, and then proceeds to the next patient. There is often little control over how the patient carried out the training program.

The system will be able to compare the training program with models that are in-memory. This allows the physiotherapist or other staff to go through the exercise performed and check that the patient performed the exercise according to the instructions. The physiotherapist can, on the basis of this review, determine whether the training went well, or whether he / she must contribute more together with the patient.

The system can also automatically store presence information, completed work tasks, any discrepancies, place / patient room, all completely without input from the employee.

The number of cases of infection that occur in hospitals, clinics, etc. is generally increasing worldwide. Some institutions have managed to keep the number of infections occurring in the hospital at a stable level through various measures. Other hospitals experience an increase in the number of infections.

The various hospitals, clinics and more can have different approaches towards and focus on infection risk. This can be, for example, available human resources in the workplace, finances, training, physical design of the buildings and more. Multi-resistant bacteria have now become a global problem. It is therefore in everyone's interest to take preventive measures and to fight the problem together. To achieve this, research and analysis are needed.

The information obtained through the use of the new system can be collected and stored. For example, the following may be stored (but not limited to the following):

1. General condition at admission.

2. Number of infections, by sex and age.

3. Number of extra days in bed due to infections.

4. Fasting disability / death as a result of infections.

5. Costs for the institution as a result of infections.

6. Time and place.

By comparing different departments and different hospitals with one another, one can find out if there are any factors that affect the number of infections. For example, one can try to find out if there is a connection between the number of infections and:

1) Training.

2) Number of employees.

3) Institutional finances.

4) Serviced or not serviced buffet.

5) Buildings, maintenance and design.

The hospitals / clinics can in this way learn from each other and introduce measures where one sees that this has had a positive effect on other institutions.

DESCRIPTION OF FIGURES

The invention will now be described by way of examples and with reference to the accompanying figures.

Figure 1 shows an example of a patient room with a possible location of a recording unit.

Figure 2 illustrates how the system can guide two nurses who care for a patient.

Figure 3 illustrates how the system can guide a nurse who cares for a patient.

Figure 4 shows a patient who has gone to bed after being outside the patient room.

Figure 5 shows an example of a basin according to the invention with disinfectant.

Figure 6 shows an example of a combined basin intended for soap and water and disinfectant fluid.

Figure 7 illustrates the communication between RFID transponders on the patient's arm and an RFID antenna located in the ceiling.

Figures 1-3 illustrate the use of a system for monitoring and providing guidance to healthcare personnel for hygiene purposes, in this case a patient room with a bed 11. The bed 11 constitutes a hygiene area where the hospital's hygiene routines are to be followed to avoid the risk of contagion and infection risk as previously described. in this document. A basin 12 with disinfectant fluid is mounted on the bed 11. This mounting lowers the threshold to clean the hands both for patients, relatives and staff.

Figure 2 shows an example of the system being able to guide two nurses 14, 15 who care for a patient. The nurses 14, 15 have in this example an identification unit, e.g. attached to the nameplate, as a separate pin, sewn into the uniform, etc., which unit has as task to identify persons in the hygiene area, in this case the bed 11. A recording unit 10 is provided in the roof for recording data representing the presence and movement of the identification unit within the hygiene area, and thus whether the nurses are present in the hygiene area. A processing unit is connected to the recording unit to process data from the recording unit.

The identification unit may be a radio transponder, e.g. an RFID transponder or other device with radio transmitter / receiver.

The recording unit 10 may be a radio transmitter / receiver, lidar, radar and / or another type of object identification and tracking. The recording unit may for example be mounted in the ceiling over the patient bed, on the wall behind the patient bed or on the bed itself.

The recording unit may also comprise a communication unit and a blue, a green, a red and a yellow light source.

All devices can be connected to each other by radio signal. A computer program then controls the communication between the various units. This program can be taught to recognize work operations performed in and near the patient zone. Examples of work operations are the replacement of the catheter, the use of stethoscopes, various physiotherapy exercises, washing and care etc.

According to all hospital procedures, health professionals should wash themselves before entering a hygiene area, in this case the patient zone, that is, the bed, and when they move from one patient to another. This can be solved in this way, using lidar as an example of a recording unit in combination with RFID transponder: When a person (or more) enters a patient room, it is registered by the lidar and a device that reads the RFID transponders (carried by the employees and the patients). The system then monitors whether the staff is washing their hands before they begin the work of examining or caring for the patient.

The basins will send a signal to the system. The lidar will also do that. It is then known that the person standing by the bed has washed his/her hands. The device hanging on the ceiling over the patient sends out a green light that hits the bed edge. The green light turns off automatically after a few seconds.

If the person in question has not visited the basin before starting the visit with the patient, a red light will fall over the edge of the bed. This light is not turned off until the health care professional removes himself from the patient zone. Other signals are of course also possible.

During the care of the patient there may be a need to wash their hands again. If one has been in contact with an unclean area, then the procedure indicates that one should wash again. The system will register that one has been in contact with an unclean area and will again send out a red or green light depending on whether the person has visited the basin or not.

The infection can also be transmitted to the patient via medication that the patient is given and via the food served. Good hand hygiene therefore applies not only to the patient room, but to health institutions in general.

In Figure 2, it is illustrated that one nurse 14 has followed the hospital's procedures regarding hand hygiene, but not the second nurse 15. The system has identified the nonconformity and an indicator unit arranged with or near the recording unit 10 adapted to transmit status by for instance sending out light or sound, here emits a red light (x) hitting the bed in front of the nurse 15 who has not followed the hospital’s procedures with respect to hand hygiene. The light is not turned off until

the nurse moves away from the bed. A green light (v) hits in front of the other nurse 14. It indicates that the hospital's hand hygiene procedures have been followed. The light goes out after a few seconds.

Figure 3 illustrates that the system guides a single nurse 14, who nurses a patient 13. There are no deviations with respect to hand hygiene, but a deviation in how the work itself is performed. The indicator unit emits a yellow light that hits the bed. The light may have a shape as a question mark.

Figures 1-3 illustrate a patient room with a possible location of the recording unit 10. The unit 10 can also be placed on the wall, directly on the bed or other suitable place. In some cases, there may be a need for more than one unit to cover the patient area, e.g. due to the design of the patient room.

Figure 4 shows a patient 43 walking to and lying down in bed 41 after having been outside the patient room. He did not wash his hands until he entered the bed. The system has detected the deviation and responds by displaying a red light in the ceiling over the patient's bed. The purpose of this is that both the patient and any health personnel who pass by are made aware of the deviation. When the patient 43 washes his hands in the basin 42, a sensor mounted in the basin, e.g. in the form of an antenna communicating with the patient's armband 46, receives signal from an identification unit, e.g. an RFID tag on the patient's bracelet. The signal is forwarded to the processing unit, which detects that the patient has washed his hands. Therefore, red light will not be lit when the patient 43 is now lying in bed.

Figure 5 shows an example of a device 50 for cleaning hands. The device is in the form of a basin with a tank for disinfectant. The basin includes one or more holes (chambers) 51 into which the hands or other objects to be cleaned are entered. For example, the basin may be used to clean instruments used in patient care. A number of nozzles 52 are located in the chamber. The nozzles press the disinfectant from the tank, into the chamber and towards the hands (or instruments). A sensor ensures that the process starts automatically when both hands are fully inserted into the chamber.

The basin is more effective than the traditional basin and known methods of using the dispenser and disinfectant to clean the hands. The basin can therefore advantageously be used in places where today the above-mentioned cleaning methods are used, and generally in places where good hygiene is important, and / or where for various reasons it can be difficult to carry out the washing process.

In some cases, the cleaning agent may be mixed with other liquid, e.g. water. To regulate the effect of the jet, the pressure through the nozzles can be regulated, air, diluted liquid / foam or gas can be supplied together with the cleaning agent and the

nozzles can rotate. It is also possible to make a variant in which the entire chamber rotates.

In one embodiment, the basin will flush itself clean after use by the nozzles 52 emitting a powerful jet of disinfectant fluid. A variant uses UV light for cleaning in addition to or alternatively to flush with disinfectant fluid.

The same type of basin, with chamber and nozzle, can also be used for washing/cleaning with soap and water. In some embodiments, the same chamber is used for both washing options.

In one embodiment, the basin can be included in said system, which is to prevent and safeguard the hygiene requirements in hospitals, clinics and more. This embodiment can be equipped with sensor and radio communication so that it can communicate with the other devices included in the system.

Figure 6 shows an example of a combined basin 70 intended for soap and water and disinfectant liquid. One part 71 consists of two holes (chambers) into which the hands are inserted. A number of nozzles are located in the chamber, as in the device of figure 5. The nozzles push the disinfectant into the chamber and towards the hands. A sensor ensures that the process starts automatically when both hands are fully inserted into the chamber.

After use, the basin will flush itself clean by the nozzles emitting a powerful jet of disinfectant.

The second part 72 consists of a traditional basin for soap and water. The basin can be irradiated with UV light when closed for further disinfection / cleaning.

Figure 7 illustrates the wireless communication between the identification unit, e.g. The RFID transponder, on the patient's arm and the recording unit, e.g., RFID antenna, which in this case is located in the roof. An RFID antenna may also be located other places than in the roof.

CLAIMS

1. System for monitoring and providing guidance to health professionals for hygiene purposes where the system comprises
- a hygiene area,
- an identification unit for identifying persons in the hygiene area,
- a recording unit for recording data representing the presence and movement of the identification unit within the hygiene area and
- a processing unit for processing data from the recording unit.

2. The system of claim 1, wherein the identification unit is a portable unit adapted to be carried at or near a user's hand and wherein the identification unit comprises a radio transmitter adapted to transmit at least one radio response signal in response to reception of at least one radio query signal and wherein the recording unit includes at least one radio transmitter and receiver.

3. A system according to claim 2, comprising at least three radio transmitters configured to transmit at least one radio interrogation signal and receive at least one radio response signal.

4. The system of claim 1 or 2, wherein the identification unit is an RFID transponder.

5. The system of claim 1, wherein the recording unit is a lidar or radar.

6. A system according to any of the preceding claims, wherein the processing unit is connected to the radio transmitters and adapted to process the received signals to identify the position of the identification unit.

7. The system of claim 1, wherein the processing unit is adapted to compare received data from the recording unit with mathematical models stored in a memory unit connected to the processing unit.

8. The system of claim 5, wherein the processing unit is adapted to, based on the signals from the recording unit, identify, distinguish, and recognize persons, objects, and movements located in the hygiene area.

9. A system according to claim 5, wherein the processing unit is adapted to, based on the comparison, classify the status of the identification unit to clean / non-clean.

10. The system of claim 6, comprising an indicator unit adapted to convey the status of the identification unit, e.g. to send out light or sound.

11. A system according to any of the preceding claims, wherein the processing unit is adapted to provide a guidance signal.

12. System according to one of the preceding claims, comprising a station for cleaning.

13. A system according to any one of the preceding claims, comprising a pressure sensor capable of detecting the presence of a patient in a bed.

14. A system according to any one of the preceding claims, comprising a central computer and means for communicating between the processing unit and the central computer.

15. System according to one of the preceding claims, wherein the recording unit comprises a communication unit and a light signal source.

16. A method of monitoring and providing guidance to healthcare personnel for hygiene purposes, wherein the method comprises
- identifying persons within a hygiene area,
- to record data representing the presence and movement of the identified persons in the hygiene area, and
to process the recorded data.

17. A method according to claim 16, wherein persons are identified by radio signals transmitting at least one radio response signal in response to receiving at least one radio query signal.

18. A method according to claim 16 or 17, wherein the identification is performed by RFID transponder, lidar or radar.

19. A method according to any one of the preceding claims, where the recorded data is processed to identify the position of the identification unit.

20. A method according to claim 16, wherein received data from the recording unit is compared to mathematical models stored in a memory unit connected to the processing unit.

21. A method according to claim 16, comprising, based on the signals from the recording unit, identifying, distinguishing and recognizing persons, objects and movements located in the hygiene area.

22. A method according to claim 16, comprising, based on the comparison, classifying the status of the identification unit to clean / non-clean.

23. A method according to any one of claims 16 to 22, comprising providing a guidance signal.

24. A device for cleaning hands and / or instruments comprising a container for cleaning agent, at least one chamber adapted to receive hands or objects to be cleaned, the chamber(s) comprising nozzles for transferring cleaning agent from containers to the chamber and providing a flow of cleaning agent into the chamber.

25. A device according to claim 24, wherein the cleaning agent is a disinfectant, soap and water or a combination thereof.

26. A device according to claim 24, comprising at least one sensor for detecting when the hands or article to be cleaned are properly located in the chamber and a control unit connected to the nozzle(s) and adapted to activate the nozzles(s) when detecting that the hands or the object to be cleaned are correctly placed in the chamber and deactivate the nozzle(s) when the hands or the object to be cleaned are removed from the chamber.

27. An apparatus according to claim 24, comprising tight walls and a front cover, a sensor for detecting the presence of a person and a control unit for opening the lid when the sensor detects presence.

28. Apparatus according to claim 24, comprising an antenna capable of communicating with RFID transponders and with a processing unit.

29. Device according to claim 24, comprising a UV source which irradiates the chamber(s) internally when not in use.

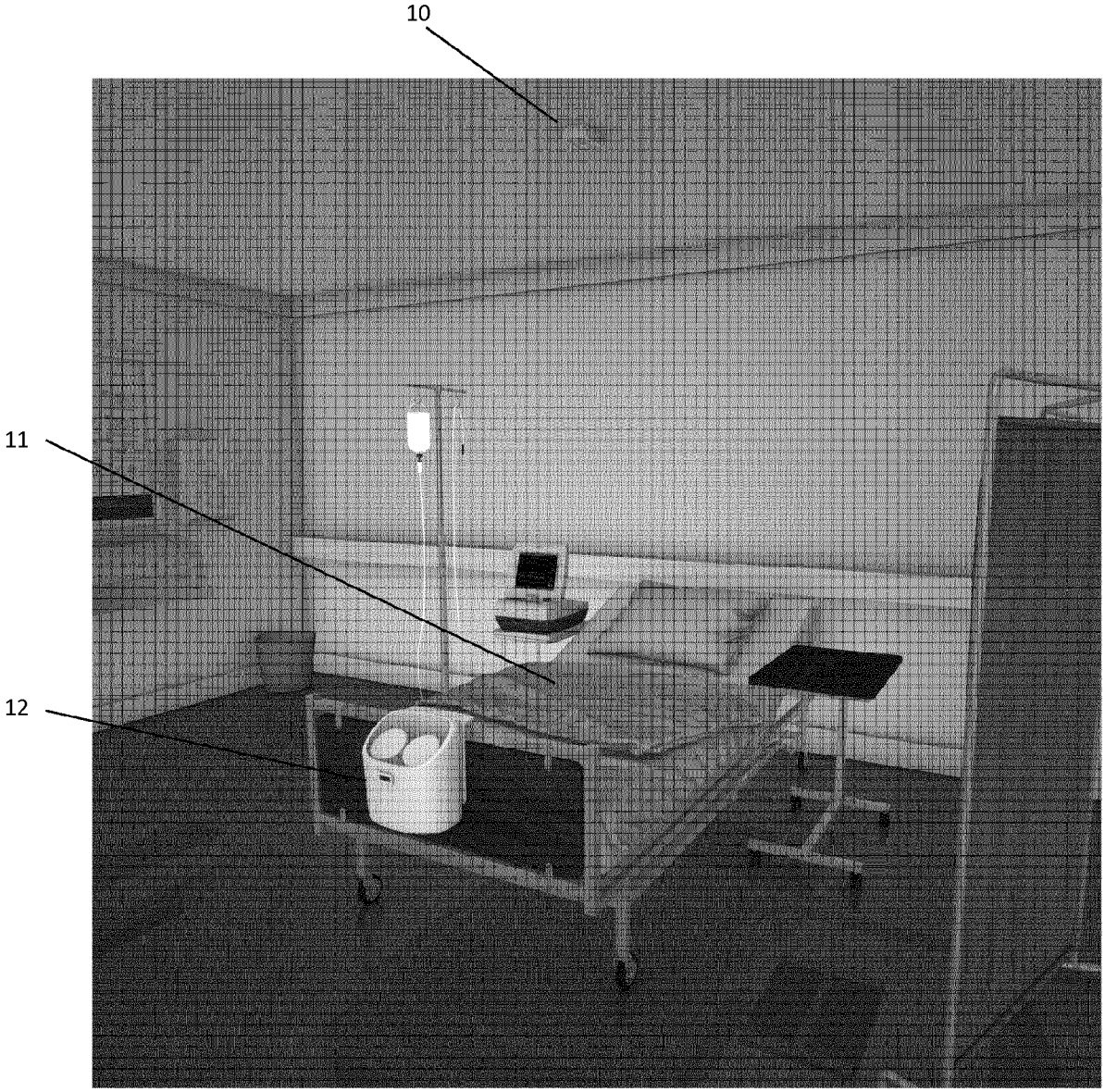

Figure 1

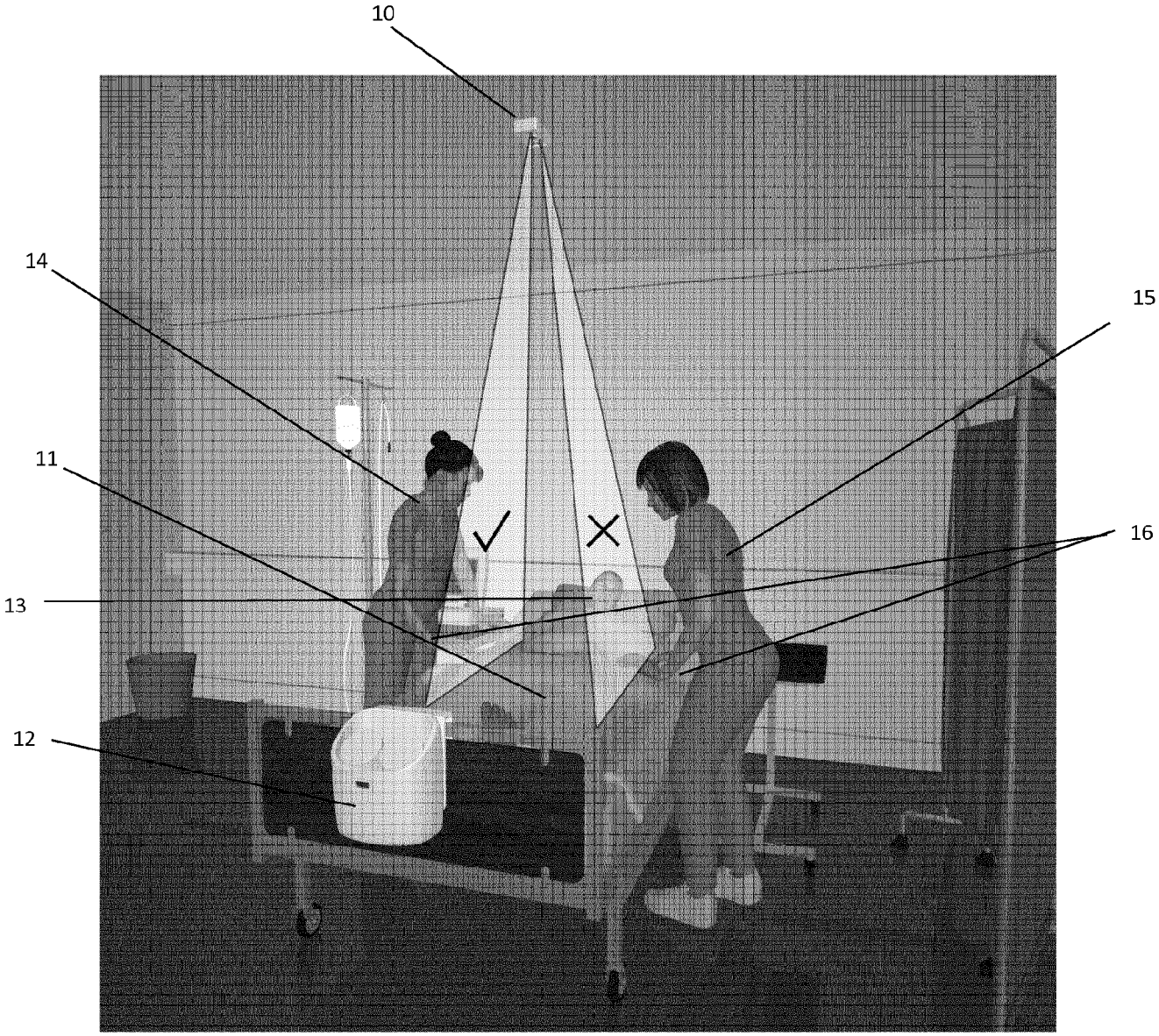

Figure 2

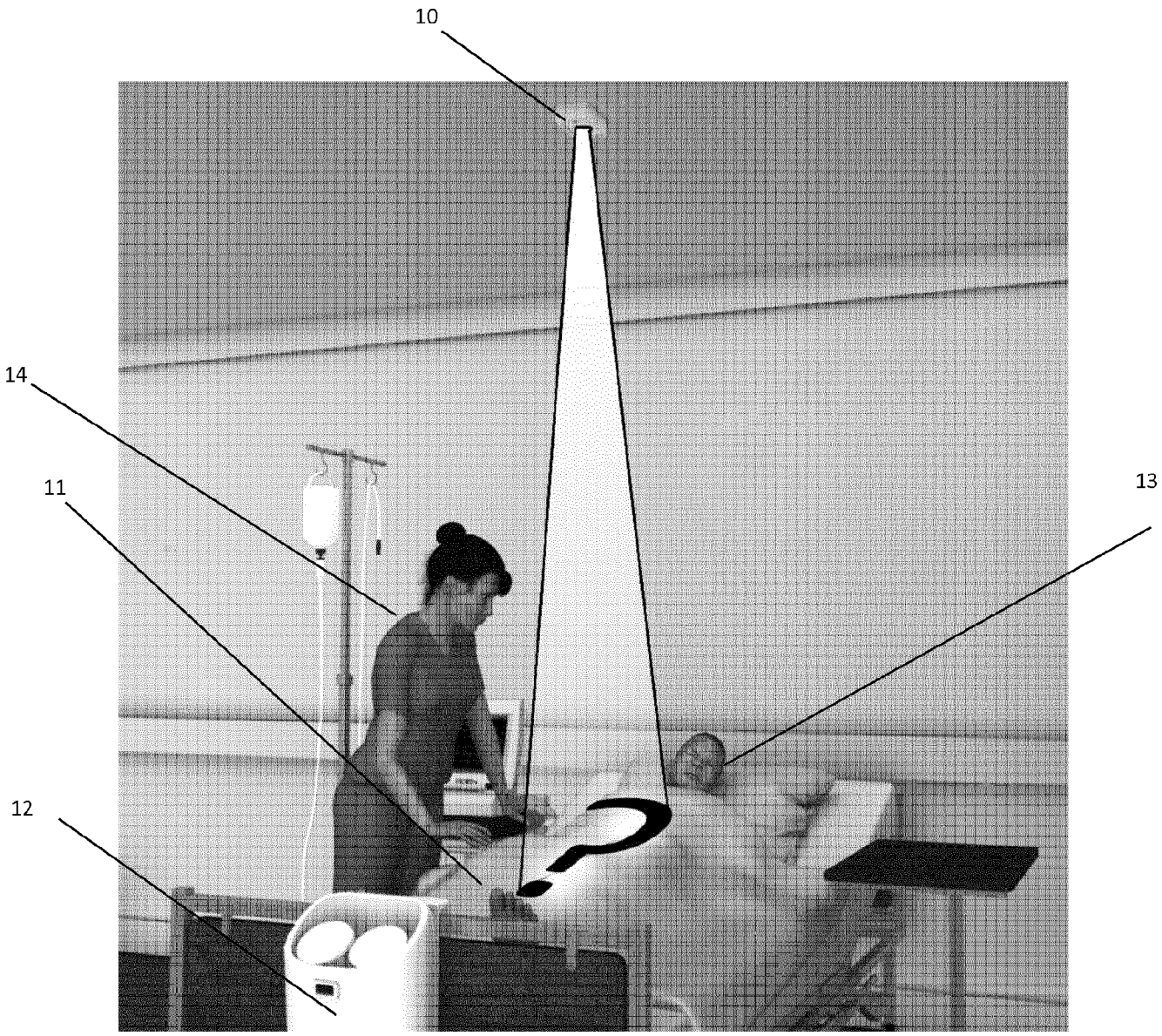

Figure 3

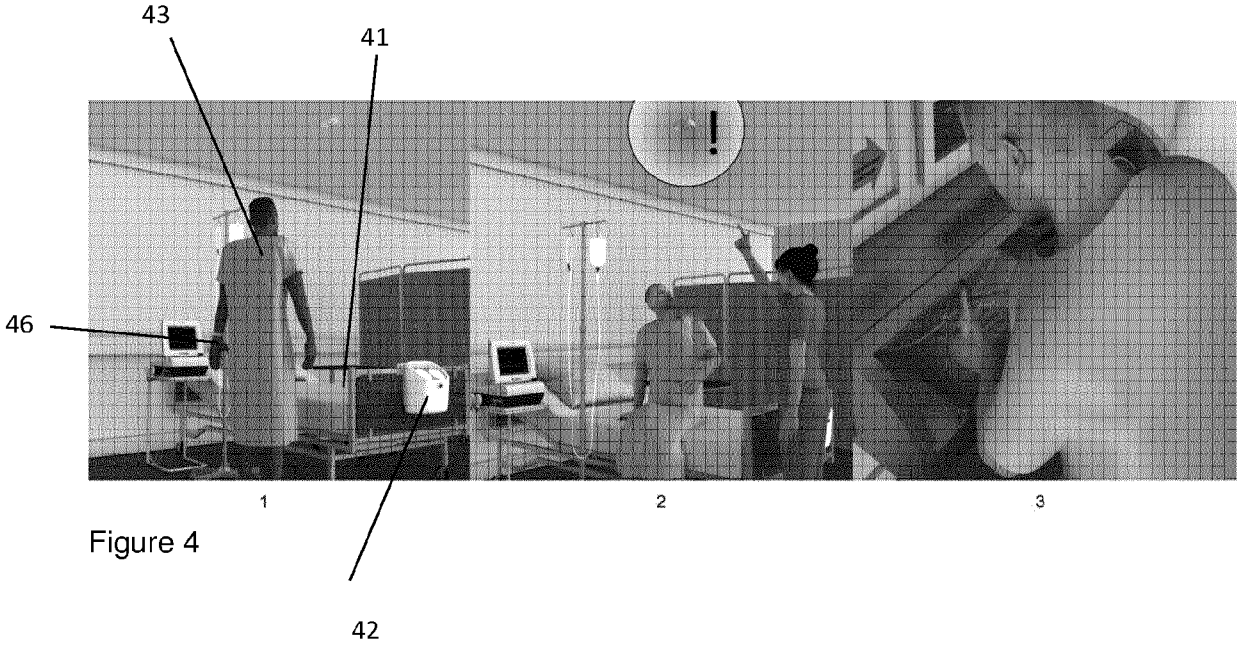

Figure 4

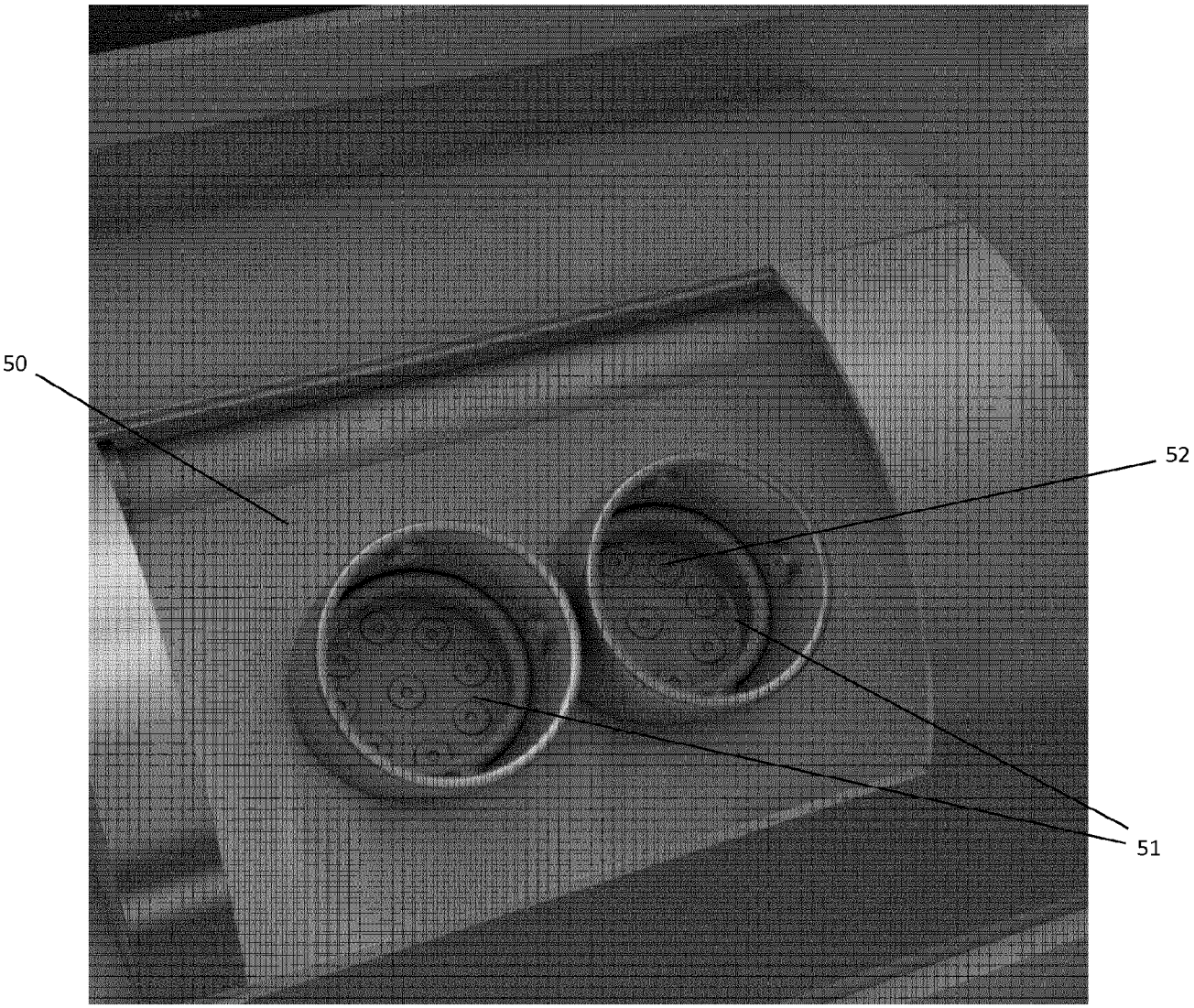

Figure 5

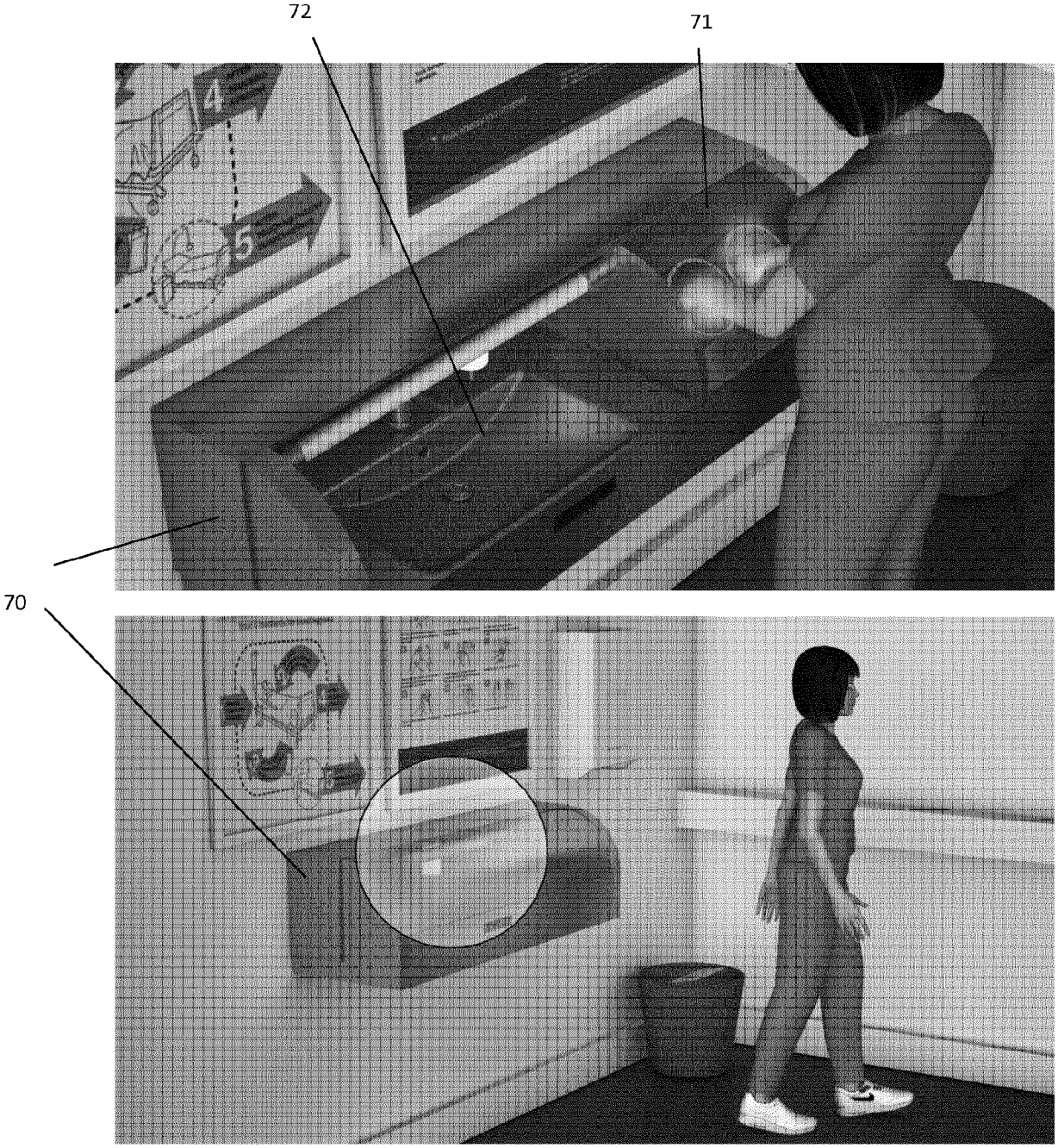

Figure 6

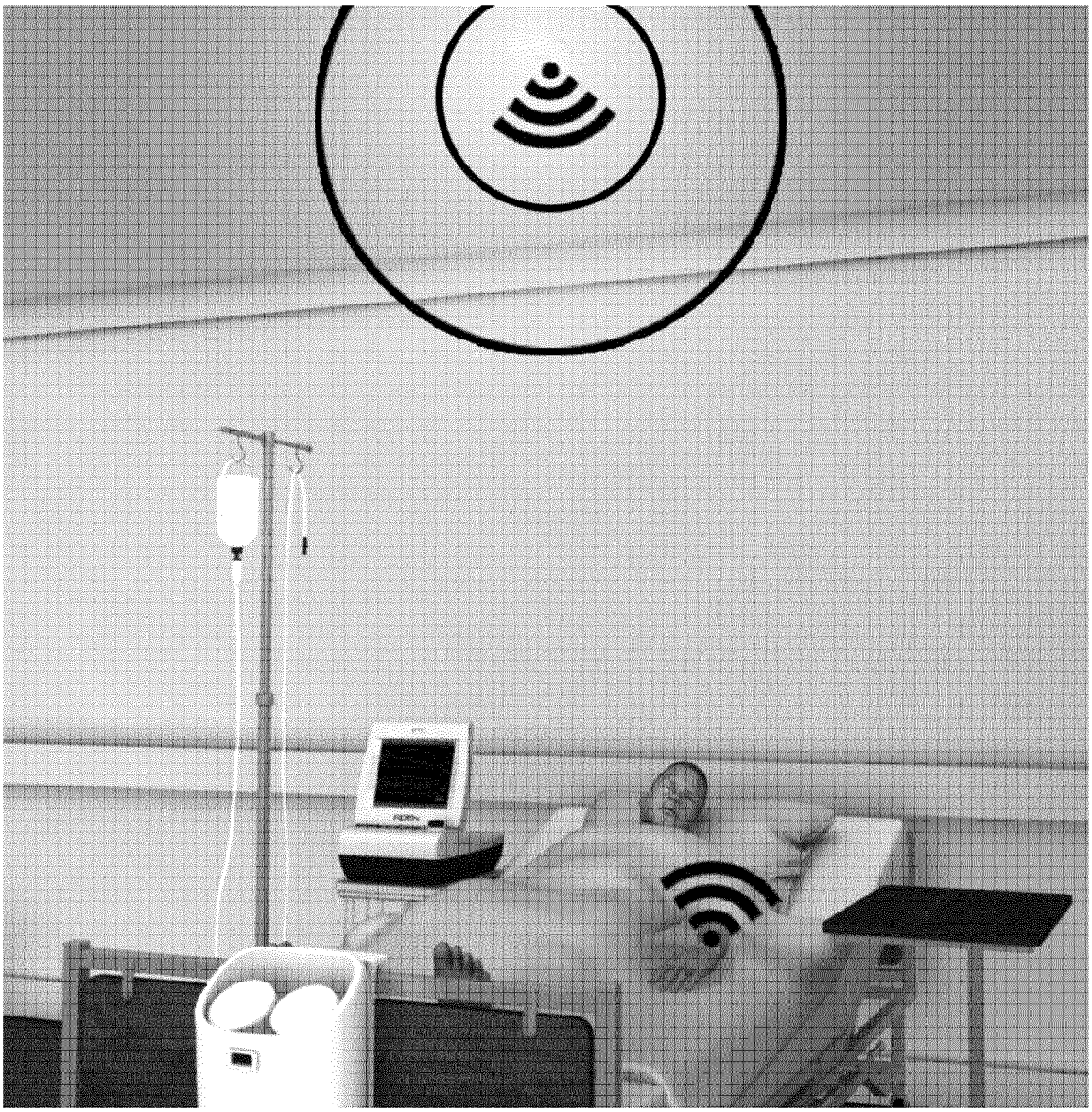

Figure 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/054107

A. CLASSIFICATION OF SUBJECT MATTER
INV. G16H40/20 A47K1/02
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)
G16H A47K

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.
A	US 2009/301523 A1 (BARNHILL PAUL R [US] ET AL) 10 December 2009 (2009-12-10) paragraphs [0114], [0116], [0207]; claim 1; figures 2, 27, 29	1-23

X	US 2012/212582 A1 (DEUTSCH RICHARD [US]) 23 August 2012 (2012-08-23)	1-4, 6-12, 14-23
Y	paragraphs [0003], [0054], [0055], [0064], [0077], [0085], [0086], [0090]; figures 1, 2, 9A, 9B, 16; example 1	5,13

Y	US 2012/154582 A1 (JOHNSON CHRISTOPHER DONALD [US] ET AL) 21 June 2012 (2012-06-21) paragraph [0053]	5

	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] 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) orwhich 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	Date of mailing of the international search report
12 April 2019	17/06/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Beligny, Samuel

1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2019/054107

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-23

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/ EP2019/054107

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/109964 A1 (FLOCARD THIERRY [FR] ET AL) 15 May 2008 (2008-05-15) claims 15, 16 -----	13

1

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/054107

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009301523 A1	10-12-2009	US 2009267776 A1	29-10-2009
		US 2009272405 A1	05-11-2009
		US 2009273477 A1	05-11-2009
		US 2009299787 A1	03-12-2009
		US 2009301523 A1	10-12-2009
		US 2012073604 A1	29-03-2012
		WO 2009134931 A2	05-11-2009
US 2012212582 A1	23-08-2012	NONE	
US 2012154582 A1	21-06-2012	CA 2810867 A1	22-03-2012
		CN 103189871 A	03-07-2013
		CN 108133274 A	08-06-2018
		US 2012154582 A1	21-06-2012
		US 2017364644 A1	21-12-2017
		US 2018174682 A1	21-06-2018
		WO 2012037192 A1	22-03-2012
US 2008109964 A1	15-05-2008	US 2008109964 A1	15-05-2008
		US 2011068932 A1	24-03-2011

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-23

   System and method for monitoring and providing guidance to health professionals for hygienes purposes

   ---

2. claims: 24-29

   Device for cleaning hands and / or instruments
