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DISINFECTION OF SURFACES IN CONFINED ENVIRONMENTS

Abstract

A method of performing, tracking, and controlling airborne disinfection of surfaces of a confined environment and objects contained therein is provided. The method involves associating an environmental identification device to the confined environment and providing a plurality of objects associated with recognition elements and a sanitizing apparatus. Identification information about the confined environment is acquired from the environmental identification device, information about the objects is acquired from the recognition elements, and information is acquired about a decontaminating agent to be dispensed into the confined environment. The acquired information is processed and a dispensing time is calculated. The decontaminating agent is dispensed by a diffuser of the sanitizing apparatus for a calculated dispensing time. The concentration of the decontaminating agent in the confined environment is detected and certification information is made available about the airborne disinfection of the surfaces within the confined environment and the objects contained therein.

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Background/Summary

TECHNICAL FIELD

[0001] The present invention refers to a method for performing, tracking and controlling disinfection of a confined environment and of the objects contained therein.

BACKGROUND ART

[0002] In the field of sanitation, disinfection of surfaces in confined spaces is conventionally performed following pre-established operating procedures manually performed by an operator, which include applying chemical disinfectant products on surfaces of confined spaces, rinsing and drying the surfaces. The traceability of disinfection activities of the surfaces in confined spaces is carried out manually by an operator. In particular, the operator manually notes in a special register both the frequency and the results of the disinfection procedures carried out on the confined environment.

[0003] The traceability of the disinfection carried out manually by the operator may be subject to errors both in transcribing information regarding the disinfection procedure in the register, and in evaluating the validity of the disinfection procedure that has been carried out. Such registration and evaluation errors make the manual traceability method unreliable. Furthermore, errors in the traceability of disinfection may also have consequences on the health of the operator and on safety of the activities to be carried out within the confined environment after the disinfection procedures.

[0004] To overcome these drawbacks, a few recently proposed solutions suggest performing disinfection procedures of confined spaces by nebulization devices.

[0005] WO 2014/006577 A1 discloses a system for reducing bacterial content in a confined environment, comprising a nebulization device that delivers a decontaminating agent for a time calculated on the basis of information including the volume of the confined environment in which it is contained and the technical specifications of the decontaminating agent to be dispensed. Furthermore, the system described in WO 2014/006577 A1 is able to assess the concentration of the decontaminating agent in the confined environment and, therefore, to certify the conformity or non-conformity of the disinfection procedure of the confined environment.

SUMMARY OF THE INVENTION

[0006] A general object of the present invention is to guarantee bacterial decontamination of confined environments including the surfaces of objects and equipment, and to prevent or at least limit the bacterial diffusion and contamination of already sanitized environments, especially in structures with a plurality of environments to keep sanitized.

[0007] A particular object of the present invention is to improve the efficiency of the traceability of disinfection procedures.

[0008] According to another aspect, the present invention aims at reducing waste of the decontaminating agent used for the sanitization of confined environments.

[0009] These and other objects and advantages, which will be better understood hereinafter, are achieved according to the present invention by a method and a system having the features defined in the appended claims.

[0010] In summary, the present invention is based on a method for carrying out, tracing and controlling airborne disinfection of the surfaces of a confined environment and the objects contained therein. The proposed method includes the steps of: [0011] associating to a confined

environment an environmental identification device configured to contain identifying information about the confined environment and its volume; [0012] providing in the confined environment a plurality of objects, each equipped with an associated recognition means containing information identifying the object; [0013] providing a sanitizing apparatus in the confined environment to dispense airborne decontaminating agents, [0014] acquiring identification information about the confined environment from the environmental identification device, acquiring information from said recognition means associated with the objects, acquiring information about a decontaminating agent to be dispensed into the confined environment, and processing said acquired information by control and processing means; [0015] dispensing said decontaminating agent in the air by a diffuser element of the sanitizing apparatus for a dispensing time calculated by the control and processing means on the basis of the acquired information; [0016] detecting the concentration of airborne decontaminating agent in the confined environment; [0017] and [0018] providing certification information, depending on the detected concentration of decontaminating agent, certifying that the surfaces of the confined environment and the objects contained therein and associated with the recognition means have been disinfected during the dispensing step.

[0019] The expected qualitative result (disinfection, high disinfection or sterilization) is guaranteed by monitoring the concentration of the airborne product. As better explained hereinafter, the method allows documenting that the contact time between the airborne product and the surfaces contained in the confined environment, at a set concentration, has taken place in compliance with a predefined quality standard. Usually, reference is made to the EN standards followed in the experimental/registration phase. Furthermore, the method guarantees that the time for restoring the minimum safety conditions has been checked.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The features and advantages of the present invention will be better understood from the detailed description of some embodiments thereof, provided by way of non-limiting example with reference to the attached drawings, in which:

[0021] FIG. **1** is a perspective view of a confined environment in which there are an environmental identification device, a plurality of objects, and a sanitizing apparatus;

[0022] FIG. **2** is a front view of an environmental identification device comprising memory means;

[0023] FIG. **3** is a perspective view of a sanitizing apparatus for dispensing decontaminating agents;

[0024] FIG. **4**A is a perspective view of an identification sensor according to an embodiment of the present invention;

[0025] FIG. **4**B is a perspective view of a recognition means according to an embodiment of the present invention; and

[0026] FIG. **5** represents a graph showing a trend of a decontaminating agent concentration during the disinfection process.

DETAILED DESCRIPTION

[0027] Referring initially to FIG. **1**, an embodiment of a system for performing, tracking, monitoring and controlling disinfection by air of surfaces of a confined environment **1** and objects contained therein is first described.

[0028] Typically, the confined environment **1** may be a confined hospital environment, such as an operating room. The confined environment **1** may also be a confined industrial environment, and/or a confined public environment, such as an office, and/or a confined private environment, such as a domestic environment.

[0029] The system comprises at least one environmental identification device **2**, an identification

device **16** of a decontaminating agent **10**, a plurality of recognition means **5**, a sanitizing apparatus **3**, first identification sensor means **4**, second sensor means **8**, a detection sensor **11**, and control and processing means **17**, **19**.

[0030] Preferably, the environmental identification device **2** is located inside the confined environment **1**, and may be placed in a fixed and/or removable manner. The environmental identification device **2** is configured to contain and make available information that uniquely identifies the confined environment **1**.

[0031] The environmental identification device **2** may be internally equipped with memory means **7**, known per se, inside which there may be a writable printed circuit **12**, or an identification QR Code **13** (FIG. **2**).

[0032] In a preferred embodiment, the information contained in the environmental identification device **2** may be information regarding the architecture of the confined environment **1**, such as information about its volume.

[0033] In addition, the environmental identification device **2** may contain information about frequency of execution of the decontamination treatment carried out in the confined environment **1**.

[0034] According to an embodiment, the identification device **16** of the decontaminating agent **10** may be located on a collection tank **15** of the decontaminating agent **10**.

[0035] The identification device **16** of the decontaminating agent **10** may include a label inside which there may be a writable printed circuit **12**, or an identification QR Code **13**.

[0036] Information about the decontaminating agent **10** contained in the identification device **16** may comprise the type of decontaminating agent to be diffused, and/or its optimal dispensing concentration.

[0037] The confined environment **1** contains a plurality of objects, each of which is associated with an individual recognition means **5**.

[0038] The objects contained within the confined environment **1** may be fixed in the confined environment **1** and/or movable, therefore transportable from a confined environment to another confined environment.

[0039] In applications where the confined environment **1** is part of a hospital environment, the objects contained in the confined environment **1** may be, by way of example but not limited to, medical devices, such as a bed, a defibrillator, an electrocardiograph and the like.

[0040] Each recognition means **5** associated with an object contained in the confined environment **1** may contain and provide identifying information about the object to which it is associated. Each recognition means **5** may include a writable printed circuit **12** and/or an identification QR Code **13**.

[0041] In a preferred embodiment, the information contained in each of the recognition means **5** associated with objects contained in the confined environment **1** may include information about the volume of the object associated with it.

[0042] The sanitizing apparatus **3** is equipped with a diffuser **9** for dispensing airborne decontaminating agents **10** in confined environments **1** (FIG. **3**).

[0043] The specific constructional and functional features of the mechanical parts of the sanitizing apparatus **3** (which may be, for example, those disclosed in WO 2014/006577 A1, incorporated herein by reference) are not relevant for understanding the present invention; therefore, they will not be described in detail herein. The exemplary sanitizing apparatus illustrated in FIG. **3** comprises a tank **15** configured to contain the decontaminating agent **10**, a feeding cannula **14** configured to collect the decontaminating agent **10** from the tank **15**, and an electric motor **18** associated with a fan (not shown). Due to a Venturi effect, the fan collects the decontaminating agent from the tank **15** through the cannula **14** and sucks in air from the confined environment **1**, mixes the decontaminating agent proportionally to the sucked air and emits into the environment, through the diffuser **9**, a mixture of air and nebulized decontaminating agent.

[0044] Preferably, the diffuser **9** is provided with a diffuser nozzle made to mix, according to a predetermined proportion, air and decontaminating agents **10** in the form of dry fog.

[0045] According to an embodiment, the sanitizing apparatus **3** may be equipped with a diffuser nozzle associated with a system for calibrating the quantity of decontaminating agent **10** which is sucked in by the electric blower motor **18** and transformed into dry fog through a number of inclined ducting holes at the outlet of the mixed air, generating a centrifugal turbulence that facilitates the dispersion in the environment of particles with dimensions between 2 and 10 microns, preferably 5 microns, avoiding their deposit on the surfaces and creation of humidity.
[0046] The first identification sensor means **4** (FIG. **4**A) may be configured to acquire the identification information about the objects located within the confined environment **1**, contained in the recognition means **5** (FIG. **4**B) associated with these objects.
[0047] In certain embodiments the first identification sensor means **4** may modulate the width of the search range for objects as a function of the volumetric dimension of the confined environment **1** to be sanitized in which the sanitizing apparatus **3** is placed each time. The search range of the identification sensors means **4** may increase or decrease according to the acquired data relating to the volume of the confined environment, based on the data made available by the environmental identification device **2**.
[0048] The second sensor means **8** may be configured to acquire the identifying information about the confined environment **1** contained in the environmental identification device **2** and to acquire the identifying information about the decontaminating agent **10**, to be diffused in the confined environment **1**, contained in the identification device **16** of the decontaminating agent **10**.
[0049] In an embodiment, the second sensor means **8** may comprise a transponder.
[0050] The first sensor means **4** and the second sensor means **8** may comprise sensors configured for reading labels with RFID technology, and/or QR code.
[0051] The first sensor means **4**, the second sensor means **8**, the detection sensor **11** for detecting the concentration of decontaminating agent **10**, and the control and processing means **17**, **19** may be mounted on the sanitizing apparatus **3**.
[0052] In certain embodiments the first sensor means and the second sensor means coincide, so that a single sensor or reader (for example, an RFID sensor) may be used both to identify the objects **5** and acquire the identifying information about the confined environment **1**.
[0053] The detection sensor **11** is configured to detect the concentration of decontaminating agent **10** air-dispersed from the diffuser **9** of the sanitizing apparatus **3** inside the confined environment **1**.
[0054] The control and processing means **17**, **19** are configured to store and process the identifying information about the objects contained in the confined environment **1** acquired by the first sensor means **4**, the information of the confined environment **1** and the identifying information of the decontaminating agent **10** acquired by the second sensor means **8**, and the information on the concentration of air-dispersed decontaminating agent in the confined environment **1** acquired by the detection sensor **11**.
[0055] In addition, the control and processing means **17**, **19** may be configured to supervise operation and/or coordinate the activity of the sanitizing apparatus **3** as a whole, and, in particular, to supervise operation and/or control the activity of the diffuser **9** and all associated devices for its startup, operation, and shutdown.
[0056] The control and processing means **17**, **19** are configured to make certification information available and certify whether the objects contained in the confined environment have been disinfected or not, according to the concentration of decontaminating agent **10** detected by the detection sensor **11**.
[0057] The system may be associated, in a per se known manner, to a central server **6** configured to coordinate the activity of the various devices of the system.
[0058] The central server **6** may be configured to receive information about the disinfection process of the surfaces of the confined environment **1** and of the objects contained therein, and, in particular, the certification information made available by the control and processing means **17**, **19** on compliance or noncompliance of the disinfection of the surfaces of the confined environment **1**

and of the objects contained therein during the dispensing of the decontaminating agent **10**.
[0059] The certification information may be transmitted to the central server **6**, for example via Bluetooth, sms, gprs and other telecommunication technologies, or via cable. As an alternative, the certification information may be loaded from the sanitizing apparatus **3** onto a removable memory medium such as a USB key, and then transmitted to the server.
[0060] In certain embodiments, a transponder **8**, in addition to acting as a second sensor means for acquiring identification information about the confined environment, is configured to transmit the certification information processed by the control and processing means **17**, **19** to the central server **6**.
[0061] Data acquired by the central server **6** may be processed by the central server **6** itself to highlight anomalies with respect to the expected objective and certify the disinfection activities that have been performed and their history, in accordance with a pre-established control plan and with the creation of an “operational technical dossier” defined for each individual disinfected object **5** (for example, a medical device) and for each disinfected confined environment.
[0062] The steps of a method for performing, tracking and controlling airborne disinfection of surfaces of a confined environment **1** and of the objects contained therein will now be described.
[0063] First, the environmental identification device **2** configured to contain identifying information about the confined environment **1** and its volume is provided in the confined environment **1** or in its proximity. A plurality of objects is arranged in the confined environment **1**, each object being equipped with an associated means of recognition **5** which contains identifying information about the object, such as its volume. Then, the sanitizing apparatus **3**, configured to dispense the airborne decontaminating agent **10**, is placed in the confined environment.
[0064] Identification information about the confined environment **1** contained in the environmental identification device **2** is then acquired by the second sensor means **8**; identification information about the objects is acquired from the recognition means **5** associated with the objects by the first sensor means **4** and identification information about the decontaminating agent **10** to be diffused in the confined environment **1** is acquired from the identification means **16** of the decontaminating agent **10** by the second sensor means **8**. Finally, acquired information is processed by the control and processing means **17**, **19**.
[0065] In other words, the sanitizing apparatus **3** first identifies the environment in which it is positioned. Then, it identifies the quantity of objects present inside the room to determine air volume in the room and, based on this, sets the dispensing time of the decontaminating agent **10**. According to a preferred embodiment, it subtracts the volume of the identified objects to the volume of the environment, resulting in the volume of air to be treated.
[0066] Subsequently, the decontaminating agent **10** is airborne delivered by the diffuser **9** of the sanitizing apparatus **3** for a dispensing time calculated by the control and processing means **17**, **19** based on acquired information. The concentration of decontaminating agent **10** airdispersed in the confined environment **1** is detected by the detection sensor **11**.
[0067] Finally, according to the concentration of decontaminating agent detected in the confined environment **1** by the detection sensor **11**, the control and processing means **17**, **19** provide certification information, which certifies disinfection of the surfaces of the confined environment **1** and of the objects contained therein and associated with the recognition means **5** during dispensing of the decontaminating agent **10**.
[0068] Preferably, the dispensing time may be calculated based on the type of decontaminating agent **10** that is delivered and on the volume of air contained in the confined environment **1**.
[0069] The dispensing time may be calculated by the control and processing means **17**, **19** provided on the sanitizing apparatus **3**, preferably on the basis of the volume of air in the environment (depending on the quantity of objects detected by the recognition means **5**) and the type of decontaminating agent that is dispensed.
[0070] Preferably, the sanitizing apparatus **3** defines the preliminary dose of decontaminating agent

10 to be dispensed in order to achieve the presumed optimal concentration of decontaminating agent **10** air-dispersed in the confined environment **1**.

[0071] Air volume in the confined environment **1** is preferably calculated by subtracting the volume occupied by the objects contained therein from the volume of the confined environment **1**, since these data are contained in the recognition means **5** and read by the first sensor means **4**.

[0072] In an alternative embodiment, air volume in the confined environment **1** may be calculated as a percentage of the volume of the confined environment **1**.

[0073] Checking of compliance of the treatment takes place through the detection sensor **11** of the airborne product, operationally associated with the control and processing means **17**, **19**, which coordinate activation and deactivation of the decontaminating agent dispensing device.

[0074] In a preferred embodiment, the concentration of decontaminating agent **10** air-dispersed in the confined environment **1** may be periodically or continuously monitored during dispensing by the detection sensor **11**.

[0075] In certain embodiments method comprises modulating the dispensing step, regulating switching off and on of the sanitizing apparatus **3** so that the air-dispersed decontaminating agent remains in contact with the surfaces to be sanitized for an overall prescribed duration (or contact time hereinafter), with concentration values not lower than a predetermined minimum threshold concentration value.

[0076] According to an embodiment, the apparatus **3** is configured to extend the dispensing time of the decontaminating agent if, during the dispensing step, the detection sensor **11** signals that the concentration of air-dispersed decontaminating agent is lower than a predetermined minimum threshold concentration value.

[0077] As an alternative, or in addition, according to another embodiment, the apparatus **3** is configured to extend the dispensing time of decontaminating agent by switching on again to resume dispensing of decontaminating agent if, once the dispensing time calculated by the control and processing means **17**, **19**, and once the dispensing has ceased, data made available by the detection sensor **11** indicate that during the previous dispensing step, the concentration of air-dispersed decontaminating agent was lower than a predetermined concentration value minimum threshold. Alternative embodiments comprise verifying achievement of the concentration of decontaminating agent once the calculated dispensing time has elapsed.

[0078] Certification that disinfection of the surfaces of the confined environment **1** and of the objects contained therein has taken place may include a graph **24** (FIG. **5**) which shows a curve **20** representing variation over time of the concentration of air-dispersed decontaminating agent in the confined environment **1** during the disinfection procedure.

[0079] The graph indicates an optimal concentration value **21***a*, a minimum concentration value **21***b*, and a maximum concentration value **21***c*, defined according to the decontaminating agent **10** delivered during the disinfection.

[0080] In addition, the graph **24** indicates a starting time **22***a*, in which the concentration of decontaminating agent **10** air-dispersed in the confined environment **1** reaches the optimal concentration value **21***a*.

[0081] The graph **24** indicates a peak time **22***c*, in which the concentration of decontaminating agent **10** air-dispersed in the confined environment **1** reaches the maximum concentration value **21***c*. At this time instant, the apparatus **3** stops dispensing decontaminating agent **10**.

[0082] In addition, the graph **24** indicates an ending time **22***b*, in which the concentration of decontaminating agent **10** air-dispersed in the confined environment **1** reaches the minimum concentration value **21***b*.

[0083] Preferably, the graph **24** further indicates contact time **26** of the surfaces of the confined environment **1** and of the objects contained therein with the decontaminating agent **10**. The contact time **26** may be calculated as the difference between the ending time **22***b* and starting time **22***a*.

[0084] The graph **24** may further indicate a safety time **25**, in which the concentration of

decontaminating agent **10** air-dispersed in the confined environment **1** reaches the zero-concentration value, and/or restoration of environmental safety conditions.
[0085] Finally, the graph **24** may indicate a decay time **23** of the concentration of air-dispersed decontaminating agent. The decay time **23** may be calculated as the difference between the safety time **25** and the ending time **22***b*.
[0086] According to an embodiment, the method of the present invention comprises checking that the contact time of the decontaminating agent used and concentrated in the environment is maintained for a time necessary to guarantee the effectiveness certified in a previous testing and validation phase of the chemical product at the time of its official registration. In order to declare, for example, that a chemical product is a disinfectant, it is known that it is necessary to demonstrate how much of chemical product must be used (concentration) and how long it must remain in contact with the surface (contact time) to demonstrate its bactericidal ability.
[0087] For an optimal implementation of the method, the contact time **26**, determined by the interval between the instants **22***a* and **22***b*, must be monitored and maintained for a predetermined duration.
[0088] The contact time **26** begins to run, during the dispensing step, at the instant in which the level **21***a* (optimal concentration value) is reached, and continues with reaching and exceeding the level **21***c* (maximum concentration value), which coincides with stopping dispensing (according to a dispensing time determined on the basis of the calculated air volume). The contact time **26** lasts until the level **21***b* (minimum concentration value) is reached. By way of example, with the dispensing of an active ingredient based on hydrogen peroxide H2O2, the contact time may be 20 minutes. Therefore, it is not sufficient that the detected decontaminant concentration reaches or exceeds a certain value, but the concentration must not fall below a minimum threshold concentration value (**21***b*) for a predetermined duration (contact time **26**).
[0089] In the example of FIG. **5**, the graph **24** refers to a monitoring phase of the disinfection method performed in a confined sanitary environment **1**, in which an active disinfectant based on hydrogen peroxide at a concentration of 12% is airborne. The graph highlights: [0090] the saturation path of the concentration in parts per million until reaching the maximum concentration threshold **21***c*, normally between 40 ppm and 80 ppm, even more preferably in the amount of 60 ppm; [0091] the overall contact time **26** necessary to ensure the broad spectrum of action on viruses, fungi, bacteria and spores detected with instants **22***a* and **22***b* is between 10 and 30 minutes, even more preferably 20 minutes; [0092] the decay or degradation time **23**, normally comprised between 30 and 180 minutes, even more preferably 60 minutes, suitable for restoring the minimum safety conditions 25 below 2 ppm of airborne chemical product **10**.

Claims

1. A method of performing, tracking, and controlling airborne disinfection of surfaces of a confined environment and objects contained therein, the method comprising: associating to the confined environment an environmental identification device configured to contain identification information about the confined environment and a volume of the confined environment; providing in the confined environment a plurality of objects, each object being equipped with an associated recognition means containing identification information about the object; providing a sanitizing apparatus in the confined environment to dispense decontaminating agents; acquiring the identification information about the confined environment from the environmental identification device, acquiring the identification information from said recognition means associated with the objects, acquiring identification information about a decontaminating agent to be dispensed into the confined environment, and processing said acquired information by control and processing means; dispensing said decontaminating agent in the air of the confined environment by a diffuser of the sanitizing apparatus for a dispensing time calculated by the control and processing means based on

the acquired information; detecting a concentration of the airborne decontaminating agent dispensed in the confined environment; and providing certification information, depending on the detected concentration of the decontaminating agent, certifying that the surfaces of the confined environment and the objects contained therein and associated with the recognition means have been disinfected during the dispensing of the decontaminating agent.

2. The method of claim 1, wherein the recognition means further contains information about a volume of the associated object, and wherein the dispensing time is calculated based on the type of decontaminating agent being dispensed and on the volume of air contained in the confined environment.

3. The method of claim 2, wherein the volume of the air contained in the confined environment is calculated by subtracting from the volume of the confined environment the volume of the objects contained therein.

4. The method of claim 2, wherein the volume of the air contained in the confined environment is calculated as a percentage of the volume of the confined environment.

5. The method claim 1, wherein the concentration of the decontaminating agent dispensed in the confined environment is monitored during the dispensing of said decontaminating agent.

6. The method claim 1, wherein the dispensing of the decontaminating agent is controlled such that the concentration of the decontaminating agent in the confined environment does not decrease below a predetermined concentration value for a predetermined period.

7. The method claim 1, wherein the dispensing of the decontaminating agent is prolonged if, during the dispensing step, the detected concentration of the decontaminating agent in the confined environment is below a predetermined concentration value.

8. The method of claim 1, wherein the dispensing of decontaminating agent is restarted if, after said dispensing time calculated by the control and processing means has elapsed and the dispensing has ceased, the detected concentration of the decontaminating agent has been below a predetermined concentration value during a preceding dispensing step.

9. A system for performing, tracking, monitoring and controlling airborne disinfection of surfaces of a confined environment and objects contained therein, the system comprising: at least one environmental identification device located in the confined environment, the environmental identification device being configured to contain and provide identification information about the confined environment; at least one identification device of a decontaminating agent configured to contain and provide identification information about the decontaminating agent; a plurality of recognition means, each recognition means being associated with an object contained in the confined environment and containing identification information about the associated object; a sanitizing apparatus equipped with a diffuser for of dispensing the decontaminating agent; first sensor means of identification for acquiring the identification information contained in the recognition means associated with the objects contained in the confined environment; second sensor means for acquiring the identification information about the confined environment from the environmental identification device and the identification information about the decontaminating agent to be dispensed in the confined environment; a detection sensor for detecting a concentration of the decontaminating agent dispensed within the confined environment; and control and processing means for storing and processing the information acquired by said sensors and providing certification information, depending on the detected concentration of the decontaminating agent, on compliance or noncompliance of the airborne disinfection of the surfaces of the confined environment and the objects contained therein during dispensing of the decontaminating agent.

10. The system of claim 9, wherein the environmental identification device and the recognition means respectively further contain information about a volume of the confined environment and a volume of the objects contained in the confined environment.

11. The system of claim 9, wherein said first and second sensor means comprise sensors configured

to read tags RFID tags and/or QR codes.

12. The system of claim 9, wherein said second sensor means comprise a transponder.

13. The system of claim 9, wherein the sanitizing apparatus comprises said first and second sensor means, the detection sensor for detecting the concentration of the decontaminating agent, and the control and processing means.