Automated Decontamination of Complex Areas

FIELD

This disclosure relates to decontamination of complex areas and, more specifically, to methods and systems of automated decontamination of areas having hard-to-access surfaces such as aircraft cabins.

BACKGROUND

Contaminants may be introduced or appear in various areas causing the areas to become unsuitable for further use. For example, with the growing popularity of air and other types of travel and new destinations, the potential for transmission of infectious diseases has dramatically increased. Some types and levels of contamination may be controlled by air filtration, as well as wiping exposed surfaces with disinfecting agents. However, these methods can be costly, time consuming, expose humans (e.g., cleaning personnel) to contaminants and/or decontaminants, and have other unintended results. For example, many modern aircraft have large cabins with many hard to access surfaces making it difficult to perform through decontamination during short landing periods. Many hidden surfaces and small cavities may remain unattended and can retain substantial amounts of contaminants. Furthermore, many biological pathogens are quite resilient at room temperatures and require concentrated harsh chemicals, such as peroxides and/or acids, which may be undesirable for some surfaces.

A method and system for dispersing decontamination products is disclosed in US 2011/0171065 A1.

SUMMARY

Provided is a mobile decontamination unit and a method of using such a unit for decontaminating various areas, such as aircraft cabins.

According to an example, there is provided mobile decontamination unit for decontaminating an area. The mobile decontamination unit includes a base portion including a mobility module operable to move the mobile decontamination unit, and a head portion movably coupled to the base portion, and movable relative to the base portion. The head portion includes an aerosol dispersing nozzle operable to disperse a decontaminant within the area in an aerosol form comprising a decontaminant droplets, and an aerosol directing fan operable to direct the decontaminant droplets to surfaces in the area

A mobile decontamination unit comprises at least one aerosol dispersing nozzle and at least one aerosol directing fan. The nozzle disperses disinfectant in the aerosol form while the fan directs aerosol to surfaces being decontaminated. Aerosol dispersing parameters, such the nozzle and fan orientations, dispersing rate, fan speed, and the like, are determined based on area characteristics.

Specifically, orientation of different surfaces, temperature, humidity and/or other like characteristics may be considered. Some characteristics may be obtained by the mobile decontamination unit after its deployment in the area, for example, using of its sensors. Other characteristics, such as area layout, may be preloaded into the mobile decontamination unit prior

temperature may be too low or too high. These area characteristics may be changed to a set range, e.g., the range acceptable decontamination. The operation of determining the aerosol dispersing parameters may not be complete until the area characteristics are changed and within the set range. Alternatively, initial aerosol dispersing parameters may be determined and the process may continue with dispersing the decontaminant while the area characteristics are changed. New aerosol dispersing parameters may be determined when the change to the area characteristics is complete.

Changing the area characteristics can comprise operating a remote unit, which is external to the mobile decontamination unit. The mobile decontamination unit may send instructions to the remote unit to perform changes to the area characteristics. The remote unit includes a heating-ventilation-air conditioning (HVAC) unit, a humidifier, an ozone generator, and the like. The remote unit should be distinguished from components of the mobile decontamination unit that may also be operable to change the area characteristics. For example, the remote unit may be a heater, different from a heater coupled to the aerosol directing fan of the mobile decontamination unit.

Determining the aerosol dispersing parameters is performed using a unit controller of the mobile decontamination unit. Determining the aerosol dispersing parameters may also be performed remotely (e.g., by a remote unit) and then transmitted to the mobile decontamination unit. For example, a remote unit may have its own controller. The initial set of the aerosol dispersing parameters may be transmitted to the mobile decontamination unit and, in some examples, further modified at the mobile decontamination unit, for example, based on locally obtained area characteristics.

A particular advantage according to the present disclosure is that area decontamination can be carried out without the need for any manual operation of the mobile unit during decontamination, since the area characteristics are registered with the sensor, which then transmits these area characteristics to the unit controller, which then subsequently determines the aerosol dispersing parameters and controls dispersion of the decontaminant.

US 2011/0171065 A1, although disclosing a wheeled cart for the area spraying of decontaminants, discloses that manual spraying of difficult to access areas is still required in combination with an automatic vapor spray to disperse decontaminants that address the remaining areas. US 2011/0171065 A1 does not disclose a system which is capable of automatically sensing characteristics of the area to be decontaminated, whereby these characteristics are then fed to a controller which analyses the characteristics, and on the basis of this analysis determines the aerosol dispersing parameters

According to the present disclosure, following determination of the aerosol dispersing parameters, automatic dispersion of the decontaminant can either be controlled by the controller, or optionally

CLAIMS

1. A mobile decontamination unit for decontaminating an area, the mobile decontamination unit comprising:

a base portion comprising a mobility module operable to move the mobile decontamination unit; and

a head portion movably coupled to the base portion; and movable relative to the base portion, the head portion comprising:

an aerosol dispersing nozzle operable to disperse a decontaminant within the area in an aerosol form comprising a decontaminant droplets; and

an aerosol directing fan operable to direct the decontaminant droplets to surfaces in the area.

2. The mobile decontamination unit of claim 1, further comprising a unit controller operable to determine aerosol dispersing parameters based on area characteristics and to control operations of the aerosol dispersing nozzle, the aerosol directing fan, and the mobility module.

3. The mobile decontamination unit of claim 2, wherein the unit controller is operable to receive the aerosol dispersing parameters from a remote unit.

4. The mobile decontamination unit of claim 2, wherein the aerosol dispersing parameters comprise a temperature ramping profile of an air directed by aerosol directing fan.

5. The mobile decontamination unit of claim 4, wherein the temperature ramping profile is linear.

6. The mobile decontamination unit of claim 2, further comprising a database, comprising at least a portion of the area characteristics.

7. The mobile decontamination unit of claim 2, further comprising a sensor selected from the group consisting of a biological sensor, a chemical sensor, a temperature sensor, a humidity sensor, and a camera, wherein the sensor is operable to obtain the area characteristics and transmit the area characteristics to the unit controller.

8. The mobile decontamination unit of claim 7, wherein the sensor is a camera, and wherein the area characteristics is an orientation of the surfaces in the area.

9. The mobile decontamination unit of claim 2, wherein the mobility module is controllable by the unit controller based on the area characteristics obtained from the area.

10. The mobile decontamination unit of claim 1, wherein the aerosol dispersing nozzle and the aerosol directing fan are coupled to a body of the head portion.

11. The mobile decontamination unit of claim 1, wherein the aerosol dispersing nozzle and the aerosol directing fan are pivotable relative to a center axis of the mobile decontamination unit.

12. The mobile decontamination unit of claim 1, wherein the aerosol dispersing nozzle and the aerosol directing fan are rotatable around a center axis of the mobile decontamination unit.

13. The mobile decontamination unit of claim 1, wherein the head portion is dome shaped.

14. The mobile decontamination unit of claim 1, wherein the aerosol dispersing nozzle and the aerosol directing fan are movable relative to the head portion.

15. The mobile decontamination unit of claim 1, wherein the head portion is raiseable relative to the base portion.

16. The mobile decontamination unit of claim 1, wherein the head portion is operable to rotate relative to the base portion.

17. The mobile decontamination unit of claim 1, further comprising a connector for connecting a tether selected from the group consisting of an electrical power line, a pneumatic line, a communication line, and a decontaminant supply line.

18. The mobile decontamination unit of claim 1, further comprising a decontaminant storage module.

19. The mobile decontamination unit of claim 1, further comprising a communication module for communicating with a system of the area.

20. The mobile decontamination unit of claim 1, wherein the head portion is tiltable relative to the base portion.