

INDOOR AIR CLEANING SYSTEM

FIELD OF THE INVENTION

[0001] The present disclosure relates to an indoor air cleaning system, and more particularly to an indoor air cleaning system including an air cleaning device, a central control and regulation device and a communication module assembled into one piece disposed in an indoor field for detecting, locating, circulating and filtering air pollution, to meet a clean room requirement of ZAPClean Room 1~9.

BACKGROUND OF THE INVENTION

[0002] Suspended particles are defined as the solid particles or droplets contained in the air. Due to their extremely fine size, the suspended particles may enter the lungs of human body through the nasal hair in the nasal cavity easily, causing inflammation in the lungs, asthma or cardiovascular disease. If other pollutant compounds are attached to the suspended particles, it will further increase the harm to the respiratory system. In recent years, the issue of air pollution has been increasingly severe, especially with consistently high concentrations of suspended particles (e.g., PM_{2.5}). Therefore, the monitoring to the concentration of the gas suspended particles is taken more and more seriously. However, the gas flows unstably due to the variable wind direction and the air volume, and the general gas-quality monitoring station is located in a fixed place. Under this circumstance, it is impossible for people to check the concentration of suspended particles in current environment.

[0003] Furthermore, in recent years, modern people are placing increasing importance on the quality of the air in their surroundings. For example, carbon monoxide, carbon dioxide, volatile organic compounds

(VOC), PM2.5, nitric oxide, sulfur monoxide and even the suspended particles contained in the air are exposed in the environment to affect the human health, and even endanger the life seriously. Therefore, the quality of environmental air has attracted the attention of various countries. At present, how to detect the air quality and avoid the harm is a crucial issue that urgently needs to be solved.

[0004] In order to confirm the quality of the air, it is feasible to use a gas sensor to detect the air surrounding in the environment. If the detection information can be provided in real time to warn the people in the environment, it is helpful of avoiding the harm and facilitates the people to escape the hazard immediately, preventing the hazardous gas exposed in the environment from affecting the human health and causing the harm. Therefore, it is considered a valuable application to use a gas sensor detecting the air in the surrounding environment.

[0005] In addition, it is difficult to have the surveillance and control the indoor air quality. Besides the outdoor air quality, the indoor air-conditioning conditions and the pollution sources are the major factors affecting the indoor air quality. It is necessary to intelligently and quickly detect indoor air pollution sources in various indoor fields, effectively remove the indoor air pollution to form a clean and safe breathing gas state, and monitor indoor air quality in real time anytime, anywhere. Certainly, if the concentration of the suspended particles in the indoor space field is strictly controlled according to the "clean room" standard, it allows to avoid the introduction, generation and retention of suspended particles, and the temperature and humidity in the indoor space field are controlled within the required range. That is to say, the number of suspended particles in the air pollution of the indoor space field is used to distinguish their classifications,

so that it allows the indoor space field to meet the clean room requirements for safe breathing.

[0006] At present, the air pollution detection of the indoor air purification system is implemented by the gas detector to transmit the air pollution information, and then the air pollution information is transmitted to the networked cloud computing service device through the Internet of Things communication, so that the air pollution information of the outdoor field and the indoor field is stored to form a big data database of air pollution data. Based on the intelligent calculation and comparison of the big data database of air pollution data, a control command is intelligently selected to be sent to the fan of the circulating filtering device to start the regulation operation. In that, an internal circulation directed airflow is continuously generated in the indoor field, and the air pollution is directed multiple times through the filtering element to be filtered and removed, so that the gas state in the indoor field has suspended particles meeting a specific specification quantity to reach a clean room requirement of ZAPClean Room 1~9. Therefore, how to regulate the above-mentioned cleaning devices in conjunction with the gas detection module is the main subject of the present disclosure.

SUMMARY OF THE INVENTION

[0007] One object of the present disclosure is to provide an indoor air cleaning system. At least one air pollution treatment device includes an air cleaning device, a central control and regulation device and a communication module assembled into one piece for detecting, locating, circulating and filtering air pollution in an indoor field, and installed in the indoor field through a build-in or plug-in manner. The air cleaning device is combined with a gas detection module disposed therein for implementing

air pollution detection to output air pollution data. Moreover, the central control and regulation device is configured to control operations of the gas detection modules through a wired communication connection, and the gas detection module is configured to control the activation operation of the air cleaning device to filter the air pollution. A networked cloud computing service device receives the air pollution data through the wireless communication or the wired communication. Since the communication transmission can be achieved by using the wireless communication or the wired communication, the dual methods of the wired communication and the wireless communication are selected to implement an operable transmission communication mechanism. The intelligent computing comparison based on the database of the air pollution data is performed to intelligently select and output the control command. Then, the control command is transmitted to the gas detection module to regulate the activation operation of the air cleaning device through an operable transmission communication mechanism of the wired communication and the wireless communication. In that, the air pollution processing operation of the air cleaning device is controlled. Thereby, a gas state of the air pollution in the indoor field reaches a clean room requirement of ZAPClean Room 1~9.

[0008] In accordance with an aspect of the present disclosure, an indoor air cleaning system is provided, and includes at least one air pollution treatment device and a networked cloud computing service device. The at least one air pollution treatment device is disposed in an indoor field. The air pollution treatment device includes an air cleaning device, a central control and regulation device and a communication module assembled into one piece for detecting, locating, circulating and filtering air pollution. The air cleaning device includes a gas detection module, the gas detection

module detects the air pollution to generate air pollution data and transmit the air pollution data to the communication module for networking output, and the central control and regulation device is connected to the gas detection module through wired communication for regulating operations of the gas detection module, so that the gas detection module is allowed controlling processing operations of the air cleaning device to filter the air pollution. The networked cloud computing service device receives the air pollution data through communication transmission. The air pollution data are received and stored to form a big data database of the air pollution, and a control command is intelligently selected to be send based on intelligent calculation and comparison of the air pollution data, and transmitted to the gas detection module of the air pollution treatment device for receiving, so that the processing operations of the air cleaning device are controlled to filter the air pollution, and a gas state of the air pollution in the indoor field reaches a clean room requirement of ZAPClean Room 1~9.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above contents of the present disclosure will become more readily apparent to those ordinarily skilled in the art after reviewing the following detailed description and accompanying drawings, in which:

[0010] FIG. 1A is a schematic diagram illustrating a transmission relationship between gas detection modules of an indoor air cleaning system according to an embodiment of the present disclosure through wired communication or wireless communication;

[0011] FIG. 1B is a schematic view illustrating then indoor air cleaning system implemented in an indoor field according to an embodiment of the present disclosure;

[0012] FIG. 2 is a schematic diagram illustrating a regulation-device control circuit of the gas detection module in the indoor air cleaning system according to an embodiment of the present disclosure;

[0013] FIG. 3A is a schematic diagram illustrating the combination of the fan and filtering element of the air cleaning device of the present disclosure;

[0014] FIG. 3B is a schematic diagram illustrating the combination of the filtering elements of the air cleaning device of the present disclosure;

[0015] FIG. 3C is a schematic diagram illustrating the regulation operation of relative components of the air cleaning device according to the embodiment of the present disclosure;

[0016] FIG. 3D is a schematic diagram illustrating the regulation operation of the air cleaning device with an ultraviolet lamp component according to an embodiment of the present disclosure;

[0017] FIG. 4A is a schematic perspective view illustrating the gas detection module implemented in the outdoor field or the indoor field according to the embodiment of the present disclosure;

[0018] FIG. 4B is a schematic perspective view illustrating the gas detection module implemented in the outdoor field or the indoor field according to the embodiment of the present disclosure and taken from another perspective;

[0019] FIG. 4C is a schematic perspective view illustrating the gas detection module according to the embodiment of the present disclosure;

[0020] FIG. 5 is a schematic diagram of the architecture of the networked cloud computing service device according to the embodiment of the present disclosure; and

[0021] FIG. 6 shows cleanliness level comparison table of the gas state of the air pollution in the indoor field reaching the clean room requirement of ZAPClean Room 1~9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0022] The present disclosure will now be described more specifically with reference to the following embodiments. It is to be noted that the following descriptions of preferred embodiments of this invention are presented herein for purpose of illustration and description only. It is not intended to be exhaustive or to be limited to the precise form disclosed.

[0023] Please refer to FIG. 1A, FIG. 1B and FIG. 2. The present disclosure provides an indoor air cleaning system, which mainly includes at least one air pollution treatment device 1 and a networked cloud computing service device 2. The at least one air pollution treatment device 1 is disposed in an indoor field A. The air pollution treatment device 1 includes an air cleaning device 11, a central control and regulation device 12 and a communication module 13 assembled into one piece for detecting, locating, circulating and filtering air pollution in the indoor field A. In the embodiment, the air cleaning device 11 includes a gas detection module 3, the gas detection module 3 detects the air pollution to generate air pollution data and transmit the air pollution data to the communication module 13 for networking output, and the central control and regulation device 12 is connected to the gas detection module 3 through wired communication for regulating operations of the gas detection module 3, so that the gas detection module 3 is allowed controlling processing operations of the air cleaning device 11 to filter the air pollution. The networked cloud computing service device 2 receives the air pollution data through communication transmission. The air pollution data are received and

stored to form a big data database of the air pollution, and a control command is intelligently selected to be send based on intelligent calculation and comparison of the air pollution data, and transmitted to the gas detection module 3 of the air pollution treatment device 1 for receiving, so that the processing operations of the air cleaning device 11 are controlled to filter the air pollution, and a gas state of the air pollution in the indoor field A reaches a clean room requirement of ZAPClean Room 1~9.

[0024] Please refer to FIG. 2. In the embodiment, the gas detection module 3 includes at least one power conversion component 31, at least one sensing component 32, at least one microcontroller (MCU)33, at least one wireless communication component (WI-FI) 34 and at least one central control communication interface component 35. In the embodiment, an AC power is inputted into the power conversion component 31 and converted as a required DC power, the DC power is then outputted for the sensing component 32, the microcontroller 33, the wireless communication component 34 and the central control communication interface component 35. Preferably but not exclusively, an AC power is inputted into the power conversion component 11 and converted into a required DC voltage of 5 V and a required DC voltage of 3.3 V, respectively. The required DC voltage of 5 V is provided to the sensing component 32 and the central control communication interface component 35, and the required voltage of 3.3 V is provided to the sensing component 32, the microcontroller 33 and the wireless communication component 34, but the present disclosure is not limited thereto.

[0025] In the embodiment, the sensing component 32 includes a sensing element for detecting air pollution. Preferably but not exclusively, the sensing component 32 detects the air pollution, and outputs air

pollution data for the microcontroller 33 calculating and processing. The microcontroller 33 outputs a plurality of regulation signals. Notably, in the embodiment, the air pollution is at least one selected from the group consisting of suspended particles, particulate matter, ozone, carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen dioxide, acetaldehyde, acetamide, acetonitrile, acetophenone, 2-acetylaminofluorene, acrolein, acrylamide, acrylic acid, acrylonitrile, propylene chloride, 4-aminobiphenyl, aniline, o-anisidine, asbestos, benzene, benzhidine, trichlorotoluene, benzyl chloride, biphenyl, di(2-ethylhexyl) phthalate (DEHP), dichloromethyl ether, tribromoform, 1-bromopropane, 1,3-butadiene, calcium cyanamide, caprolactam, captan, carbaryl, carbon disulfide, carbon tetrachloride, carbonyl sulfide, catechol, chloramben, chlordane, chlorine, chloroacetic acid, 2-chloroacetophenone, chlorobenzene, chlorobenzilate, chloroform, chloromethyl methyl ether, chloroprene, cresol/methanesulfonic acid (isomers and mixtures), o-cresol, m-cresol, p-cresol, cumene, 2,4-dichlorophenoxyacetic acid, salts and esters, dichlorodiphenyldichloroethylene (DDE), diazomethane, dibenzofuran, 1,2-dibromo-3-chloropropane, dibutyl phthalate, 1,4-dichlorobenzene, 3,3-dichlorobenzidine, dichloroethyl ether (bis(2-chloroethyl)ether), 1,3-dichloropropene, dichlorvos, diethanolamine, N,N-dimethylaniline, diethyl sulfate, 3,3-dimethoxybenzidine, dimethylaminoazobenzene, 3,3'-dimethylbenzidine, dimethylcarbamate chloride, dimethylformamide, 1,1-dimethylhydrazine, dimethyl phthalate, dimethyl sulfate, 4,6-dinitro-o-cresol and its salts, 2,4-dinitrophenol, 2,4-dinitrotoluene, 1,4-dioxane (1,4-ethylene dioxide), 1,2-diphenylhydrazine, epichlorohydrin (1-chloro-2,3-epoxy propane), 1,2-butylene oxide, ethyl acrylate, ethylbenzene, ethyl urethane (ethyl carbamate), ethyl chloride, dibromoethane, dichloroethane (1,2-dichloro ethane), ethylene glycol,

ethyleneimine (azirine), ethylene oxide, ethylene thiourea, dichloroethane (1,1-dichloroethane), formaldehyde, heptachlor, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, hexachloroethane, 1,6-hexamethylene diisocyanate, hexamethylphosphonamide, hexane, hydrazine, hydrochloric acid, hydrogen fluoride (hydrofluoric acid), hydrogen sulfide, hydroquinone, isophorone, lindane (all isomers), maleic anhydride, methanol, potassium chloride, methyl bromide (methyl bromide), methyl chloride (methyl chloride), methyl chloroform (1,1,1-trichloroethane), methyl ethyl ketone (2-butanone), methyl hydrazine, methyl iodide (methyl iodide), methyl isobutyl ketone (cyclohexanone), methyl isocyanate, methyl methacrylate, methyl tert-butyl ether, 4,4-methylenebis(2-chloroaniline), methylene chloride, methylene diphenyl diisocyanate (MDI), 4,4'-aminodiphenylmethane, naphthalene, nitrobenzene, 4-Nitrobiphenyl, 4-nitrophenol, 2-nitropropane, N-nitroso-N-methyl urea, N-nitroso dimethylamine, N-nitroso morpholine, Parathion, pentachloronitrobenzene (pentabenzene), pentachlorophenol, phenol, p-phenylenediamine, phosgene, phosphine, phosphorus, phthalic anhydride, polychlorinated biphenyls (Aroclors), 1,3-propane sultone, β -propiolactone, propionaldehyde, propoxur (Baigon), dichloropropane (1,2-dichloropropane), propylene oxide, 1,2-propylene imine (2-methylaziridine), quinoline, quinone, styrene, styrene oxide, 2,3,7,8-tetrachlorodibenzo-p-dioxin, 1,1,2,2-tetrachloroethane, tetrachloroethylene (perchloroethylene), titanium tetrachloride, toluene, 2,4-toluenediamine, 2,4-toluene diisocyanate, o-toluidine, toxaphene (camphene chloride), 1,2,4-trichlorobenzene, 1,1,2-trichloroethane, trichloroethylene, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, triethylamine, trifluralin, 2,2,4-trimethylpentane, vinyl acetate, bromine ethylene, vinyl chloride, vinylidene chloride (1,1-dichloroethylene), xylene,

o-xylene, m-xylene, p-xylene, antimony compounds, arsenic compounds (inorganic, including arsine), beryllium compounds, cadmium compounds, chromium compounds, cobalt compounds, coke oven emissions, cyanide, glycol ethers, lead compounds, manganese compounds, mercury compounds, fine mineral fibers, nickel compounds, polycyclic organic compounds, radioactive nuclides (including radon), selenium compounds, bacteria, fungi, viruses and a combination thereof.

[0026] The sensing component 32 of the gas detection module 3 of the present disclosure not only detects the suspended particles in the gas, but also detects the characteristics of the introduced gas. Therefore, the sensing component 32 of the gas detection module 3 further includes a particle sensing element 32a, a temperature and humidity sensing element 32b and a gas sensing element 32c, or is expanded to include other sensing elements, such as a bacteria sensing element 32d, a fungus sensing element 32e and a virus sensing element 32f for detecting the introduced air pollution. Notably, in the embodiment, the sensing component 32 is a particle sensing element 32a for detecting the air pollution data of the suspended particles (PM1, PM2.5, PM10) contained in the gas and in particulate state. Preferably but not exclusively, the sensing component 32 is a temperature and humidity sensing element 32b for detecting the air pollution data of the temperature and humidity of the air. Preferably but not exclusively, the sensing component 32 is a gas sensing element 32c for detecting the air pollution data of gas molecules contained in the air. Preferably but not exclusively, the sensing component 32 includes a bacteria sensing element 32d for detecting the air pollution data of bacteria contained in the air. Preferably but not exclusively, the sensing component 32 includes a fungus sensing element 32e for detecting the air pollution data of fungus contained in the air. Preferably but not

exclusively, the sensing component 32 includes a virus sensing element 32f for detecting the air pollution data of virus contained in the air. The present disclosure is not limited thereto.

[0027] In the embodiment, the particle sensing element 32a is disposed in an indoor field A and configured to detect if the suspended particulate matter (PM1, PM2.5, PM10) and the concentration of suspended particles contained in the air pollution exceeds a pollution threshold safety value. When the microcontroller 33 receives that the air pollution data of suspend particles exceeds the pollution threshold safety value, a plurality of regulation signals are outputted. Preferably but not exclusively, the pollution threshold safety value of suspended particulate matter 2.5 (PM2.5) includes a concentration of suspended particulate matter 2.5 (PM2.5) less than $15 \mu\text{g}/\text{m}^3$. In the embodiment, the temperature and humidity sensing element 32b is configured to detect if the temperature and humidity of the air in the indoor field A exceeds a pollution threshold safety value. When the microcontroller 33 receives that the air pollution data of the temperature and humidity of the air exceeds the pollution threshold safety value, a plurality of regulation signals are outputted. Preferably but not exclusively, the pollution threshold safety value of temperature and humidity includes a temperature of $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ and a humidity of $50\% \pm 10\%$. Preferably but not exclusively, the pollution threshold safety value of temperature and humidity is used to implement a temperature and humidity control in the indoor field A, and the temperature and humidity control is implemented to maintain a temperature of $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ and a humidity of $50\% \pm 10\%$ in the indoor field A. Preferably but not exclusively, the gas sensing element 32c is configured to detect if the air pollution data of carbon dioxide (CO_2) exceeds a threshold safety value. When the microcontroller 33 receives

that the air pollution data of carbon dioxide (CO₂) exceeds the pollution threshold safety value, a plurality of regulation signals are outputted. Preferably but not exclusively, the air pollution data of carbon dioxide (CO₂) have to be maintained below the pollution threshold safety value of 800 ppm.

[0028] In the embodiment, the microcontroller 33 receives the air pollution data outputted by the sensing component 32, and calculates and processes the air pollution data to outputs the plurality of regulation signals. The air pollution data outputted by the sensing component 32 are transmitted to the microcontroller 33 through a serial communication (IIC) signal for receiving, calculating and processing. The regulation signal outputted by the microcontroller 33 includes a Universal Asynchronous Transceiver and Transceiver (UART) signal and a General Purpose Input and Output (GP I/O) signal. The Universal Asynchronous Transceiver and Transceiver (UART) signals are transmitted through electrical wires to the air cleaning device 11, the wireless communication component 34 and the central control communication interface component 35 for receiving. The General Purpose Input and Output (GP I/O) signals are transmitted through electrical wires to the air cleaning devices 11 for receiving. Notably, as shown in FIG. 2 and FIG. 1A, the central control communication interface component 35 is connected to a communication control line and the central control and regulation device 12 for communication connection and transmission. Preferably but not exclusively, a wired communication transmission (the solid transmission line shown in FIG. 1A) under a RS485 communication protocol is used for communication connection and transmission.

[0029] Please refer to FIG. 4A and FIG. 4B, again. The gas detection module 3 can be composed of a type including an external power

terminal, and the external power terminal is directly inserted into the power interface of the indoor field A or the outdoor field B (e.g., the gas detection module shown in FIG. 1B and represented by number 3), so as to start operation of detecting the air pollution. Alternatively, as shown in FIG. 4C, the gas detection module doesn't include an external power terminal, and is directly disposed within the air cleaning device 11 in electrical connection (e.g., the gas detection module 3 shown in FIG. 1A).

[0030] Please refer to FIG. 1A. In the embodiment, the air cleaning device 11 of the air pollution treatment device 1 includes a purifier 11a, an air conditioner 11b, a full heat exchanger 11c and a dehumidifier 11d integrated into one piece for detecting, locating, circulating and filtering the air pollution, and regulating temperature, humidity and ventilation of the indoor field A. In an embodiment, the air cleaning device 11 of the air pollution treatment device 1 includes a purifier 11a, an air conditioner 11b and a full heat exchanger 11c integrated into one piece for detecting, locating, circulating and filtering the air pollution, and regulating temperature, humidity and ventilation of the indoor field A. In another embodiment, the air cleaning device 11 of the air pollution treatment device 1 includes a purifier 11a and an air conditioner 11b integrated into one piece for detecting, locating, circulating and filtering the air pollution, and regulating temperature, humidity and ventilation of the indoor field A. In other embodiments, the air cleaning device 11 of the air pollution treatment device 1 includes a purifier 11a for detecting, locating, circulating and filtering the air pollution. Preferably but not exclusively, in some embodiments, the purifier 11a, the air conditioner 11b, the full heat exchanger 11c and the dehumidifier 11d are arbitrarily integrated into one piece of the air cleaning device 11 according to the practical requirements

for detecting, locating, circulating and filtering the air pollution, and regulating temperature, humidity and ventilation of the indoor field A.

[0031] Please refer to FIG. 1A, FIG. 3A and FIG. 3C. In the embodiment, the air cleaning device 11 includes the purifier 11a, the air conditioner 11b, the full heat exchanger 11c and the dehumidifier 11d, which are arbitrarily integrated into one piece. Each of the purifier 11a, the air conditioner 11b, the full heat exchanger 11c and the dehumidifier 11d includes a fan 111, a filtering element 112 and a driving control component 113 and the gas detection module 3. In the embodiment, the gas detection module 3 is disposed within the air cleaning device 11 in electrical connection. The gas detection module 3 detects the air pollution to generate the air pollution data and transmit the air pollution data to the communication module 13 for networking output, and the central control and regulation device 12 is connected to the central control communication interface components 35 of the purifier 11a, the air conditioner 11b, the full heat exchanger 11c and the dehumidifier 11d through wired communication to receive the air pollution data for displaying. The gas detection module 3 is connected under handshake communication protocol of wired communication or wireless communication to receive an control command issued by the networked cloud computing service device 2, calculates, processes and outputs a plurality of regulation signals to the driving control component, so that activation operation of the fan 111 and a wind speed of the fan 111 are regulated, and the fan 111 is controlled to start guiding the air pollution passing through the filtering element 112 for filtration.

[0032] In the embodiment, the gas detection module 3 is electrically connected to the fan 111 and the driving control component 113 (as shown in FIG. 3C). Please further refer to FIG. 2 and FIG. 3C. In the embodiment, the air cleaning device 11 further includes a relay 114 and a

communication interface device 115. Preferably but not exclusively, the relay 114 is electrically connected to input the AC voltage outputted by the power conversion component 31 and cooperatively connected to the microcontroller (MCU) 33 to output the regulation signal (i.e., the General Purpose Input and Output (GP I/O) signal), so that the AC voltage is outputted and provided to a driving control component 113 for power control and regulation. Moreover, the communication interface device 115 is connected to input the required DC voltage of 5 V converted by the power conversion component 31, cooperating with the microcontroller (MCU) 33 to input the regulation signal (i.e., the Universal Asynchronous Transceiver and Transceiver (UART) signal) outputted therefrom, and connected to the driving control component 113 for communication connection and transmission through a communication control line to regulate a wind speed of a fan 111 of the air cleaning device 11, so that the fan 111 is controlled to start guiding the air pollution passing through the filtering element 112 for filtration. Notably, in the embodiment, the communication control line of the air cleaning device 11 is used for outputting under a RS485 communication protocol. Notably, in the embodiment, it allows to implement a plurality of air cleaning devices 11 in the present disclosure, each of the air cleaning device includes an address encoder (not shown) for connection with the wire outputting the regulation signal (i.e., the General Purpose Input and Output (GP I/O) signal), so that the plurality of air cleaning devices 11 are serially connected for regulation.

[0033] Please refer to FIG. 1A and FIG. 2. In the embodiment, the communication module 13 of the air pollution treatment device 1 communicates with the central control and regulation device 12 and the wireless communication component (WI-FI) 34 of the gas detection module 3 of the air cleaning device 11 through wireless communication to

receive the air pollution data and then transmit to the networked cloud computing service device 2, and the air pollution information is received and stored by the networked cloud computing service device 2 to form the big data database of the air pollution. Notably, in the embodiment, the communication module 13 of the air pollution treatment device 1 is a router. Preferably but not exclusively, communication transmission of the communication module 13 is a wired communication transmission or a wireless communication transmission.

[0034] In the embodiment, the networked cloud computing service device 2 intelligently computes and compares based on the air pollution data. The control command is intelligently selected and issued through the communication module 13, transmitted to the gas detection module 3 of the air cleaning device 11 for receiving, then transmitted to the driving control component 113 to regulate the activation operation of the fan 111 and the wind speed of the fan 111. In that, the fan 111 is controlled to start guiding the air pollution passing through the filtering element 112 for filtration, therefore the gas state in the indoor field A is cleaned to meet the clean room requirement of ZAPClean Room 1~9. Alternatively, in an embodiment, the networked cloud computing service device 2 intelligently computes and compares based on the air pollution data, the control command is intelligently selected and issued to the at least one central control and regulation device 12 through the communication module 13, and then the control command is transmitted to the gas detection module 3 through wired communication connection for receiving, and then transmitted to the driving control component 113 to regulate the activation operation of the fan 111 and the wind speed of the fan 111. In that, the fan 111 is controlled to start guiding the air pollution passing through the

filtering element 112 for filtration, so that the gas state in the indoor field A is cleaned to meet the clean room requirement of ZAPClean Room 1~9.

[0035] In the embodiment, the gas detection modules 3 are connected under handshake communication protocol of wired communication or wireless communication. When the wireless communication or the wired communication is disconnected, it allows to regulate and select an activation mechanism with the wired communication or the wireless communication that can operate transmission. The networked cloud computing service device 2 receives the air pollution data through the activation mechanism with the wired communication or the wireless communication that can operate the transmission, intelligently computes and compares based on the air pollution data, and then intelligently selects and issues the control command to be transmitted to the gas detection modules 3 for receiving under the connection of the activation mechanism with the wired communication or the wireless communication that can operate transmission, and then the control command is transmitted to the driving control component 113 to regulate the activation operation of the fan 111 and the wind speed of the fan 111. In that, the fan 111 is controlled to start guiding the air pollution passing through the filtering element 112 for filtration, and then the gas state in the indoor field A is cleaned to meet the clean room requirement of ZAPClean Room 1~9. Alternatively, when the gas detection modules 3 are connected under the handshake communication protocol of the wired communication or the wireless communication and the wireless communication and the wired communication are both disconnected, it allows to autonomously compute and compare the air pollution data outputted by the gas detection modules 3 based on the air pollution data, and then transmit the control command to the driving control component 113 to regulate the activation operation of

the fan 111. The fan 11 is controlled to start guiding the air pollution passing through the filtering element 112 for filtration, so that the gas state in the indoor field A is cleaned to meet the clean room requirement of ZAPClean Room 1~9.

[0036] From the above, the specific implementation of the indoor air cleaning system in the indoor field A according to the present disclosure can be understood. The specific implementation of the plurality of air cleaning devices 11 in the indoor field A will be described below. As shown in FIG. 1B, the air cleaning device 11 can be installed in the indoor field A through a build-in or plug-in manner. If the air cleaning device 11 is installed in the indoor field A through the build-in manner, at least one circulation back-flow channel C is disposed within the indoor field A. The at least one circulation back-flow channel C is surrounded and isolated by several partitions C1 to form on a side of the indoor field A, and includes a plurality of air intakes C2 and a plurality of back-flow vents C3.

[0037] In addition, as shown in FIG. 1A and FIG. 1B, the air cleaning device 11 includes a full heat exchanger 11c integrated into one piece for implementing ventilation in indoor field A. Furthermore, at least one gas detection module 3 is disposed in the outdoor field B and at least one gas detection module 3 is disposed in the indoor field A for detecting the air pollution. The networked cloud computing service device 2 receives the air pollution data of the indoor field A and the outdoor field B for storing to form the big data database of the air pollution data, and intelligently computes and compares the air pollution data of the indoor field A and the outdoor field B. When the air pollution data of the indoor field A is greater than the air pollution data of the outdoor field B, the networked cloud computing service device 2 issues the control command to be transmitted to the gas detection module 3 in the full heat exchanger 11c

through wireless communication or wired communication for receiving, and then the control command is transmitted to the driving control component 113 to regulate the activation operation of the fan 111, so that it allows to introduce gas from the outdoor field B into the indoor field A for ventilation. Notably, in the embodiment, the air pollution data detected by the gas detection modules 3 of the outdoor field B and the indoor field A are the air pollution data of carbon dioxide (CO₂), and the air pollution data of carbon dioxide (CO₂) have to be maintained below a pollution threshold safety value of 800 ppm, so that the full heat exchanger 11c introduces the gas from the outdoor field B into the indoor field A for ventilation when the air pollution data of carbon dioxide (CO₂) exceeds the pollution threshold safety value.

[0038] Please refer to FIG. 3A and FIG. 3B. In the above embodiments, the fan 111 of the air cleaning device 11 is controlled and enabled to guide the air pollution to pass through the filtering element 112 for filtration. Preferably but not exclusively, in an embodiment, the filtering element 112 is an ultra-low particulate air (ULPA) filter, a high efficiency particulate air (HEPA) filter or a combination thereof, which is configured to absorb the chemical smoke, the bacteria, the dust particles and the pollen contained in the air pollution, so that the air pollution introduced into the filtering element 112 is filtered and purified to achieve the effect of filtering and purification.

[0039] In the embodiment, the filtering element 112 of the present disclosure is further combined with physical or chemical materials to provide a sterilization effect on the air pollution, and the airflow of the fan 111 flows in the path indicated by the arrow. As shown in FIG. 3B, in the embodiment, the filtering element 112 includes a decomposition layer coated thereon to sterilize in chemical means. Preferably but not

exclusively, the decomposition layer includes an activated carbon 222a configured to remove organic and inorganic substances in air pollution, and remove colored and odorous substances. Preferably but not exclusively, the decomposition layer includes a cleansing factor containing chlorine dioxide layer 112b configured to inhibit viruses, bacteria, fungi, influenza A, influenza B, enterovirus and norovirus in the air pollution, and the inhibition ratio can reach 99% and more, thereby reducing the cross-infection of viruses. Preferably but not exclusively, the decomposition layer includes an herbal protective layer 112c extracted from ginkgo and Japanese Rhus chinensis configured to resist allergy effectively and destroy a surface protein of influenza virus (such as H1N1 influenza virus) passing therethrough. Preferably but not exclusively, the decomposition layer includes a silver ion 112d configured to inhibit viruses, bacteria and fungi contained in the air pollution. Preferably but not exclusively, the decomposition layer includes a zeolite 112e configured to remove ammonia nitrogen, heavy metals, organic pollutants, Escherichia coli, phenol, chloroform and anionic surfactants.

[0040] Furthermore, in some embodiments, the filtering element 112 is combined with a light irradiation element to sterilize in chemical means. Preferably but not exclusively, the light irradiation element is a photo-catalyst unit including a photo catalyst 112f and an ultraviolet lamp 112g. When the photo catalyst 112f is irradiated by the ultraviolet lamp 112g, the light energy is converted into the chemical energy, thereby decomposes harmful gases and disinfects bacteria contained in the air pollution, so as to achieve the effects of filtering and purifying. Preferably but not exclusively, the light irradiation element is a photo-plasma unit including a nanometer irradiation tube 112h. When the introduced air pollution is irradiated by the nanometer irradiation tube 112h,

the oxygen molecules and water molecules contained in the air pollution are decomposed into high oxidizing photo-plasma, and an ion flow capable of destroying organic molecules is generated. In that, volatile formaldehyde, volatile toluene and volatile organic compounds (VOC) contained in the air pollution are decomposed into water and carbon dioxide, so as to achieve the effects of filtering and purifying. Notably, in the embodiment, as shown in FIG. 3D, the air cleaning device 11 further comprises an ultraviolet lamp component 116, the ultraviolet lamp component 116 includes a relay 116a, and the relay 116a is connected to input an AC voltage outputted from the power conversion component 31 and cooperatively connected to the microcontroller 33 to output the regulation signal((i.e., the General Purpose Input and Output (GP I/O) signal)), so that the AC voltage is outputted and provided to a power switch 26b, and the power switch 116b is connected to control starting and regulation of the ultraviolet lamp 112g. Preferably but not exclusively, the ultraviolet lamp 112g is arranged on one side of the filtering element 112 for sterilizing the air pollution.

[0041] Moreover, in some embodiments, the filtering element 112 is combined with a decomposition unit to sterilize in chemical means. Preferably but not exclusively, the decomposition unit is a negative ion unit 112i with a dust collecting plate. It makes the suspended particles in the air pollution to carry with positive charge and adhered to the dust collecting plate carry with negative charges, so as to achieve the effects of filtering and purifying. Preferably but not exclusively, the decomposition unit is a plasma ion unit 112j. The oxygen molecules and water molecules contained in the air pollution are decomposed into positive hydrogen ions (H^+) and negative oxygen ions (O^{2-}) by the plasma ion. The substances attached with water around the ions are adhered on the surface of viruses

and bacteria and converted into OH radicals with extremely strong oxidizing power, thereby removing hydrogen (H) from the protein on the surface of viruses and bacteria, and thus decomposing (oxidizing) the protein, so as to filter the introduced air pollution and achieve the effects of filtering and purifying.

[0042] Please refer to FIG. 5. In the above embodiments, the networked cloud computing service device 2 includes a wireless network cloud computing service module 21, a cloud control service unit 22, a device management unit 23 and an application program unit 24. The wireless network cloud computing service module 21 receives the information of the air pollution data from the gas detection module 3 disposed in the outdoor field B, receives the information of the air pollution data from the gas detection module 3 disposed in the indoor field A, receives the communication information of the air pollution data from the gas detection modules 3 disposed within the plurality of air cleaning devices 11 and transmits the control commands. Moreover, the wireless network cloud computing service module 21 receives the information of the air pollution data of the indoor field A and the outdoor field B and transmits the information to the cloud control service unit 22 to store and form the big data database of the air pollution data. An artificial intelligence calculation is implemented to determine the location of the air pollution through the air pollution database comparison, so that the control command is transmitted to the wireless network cloud computing service module 21, and then transmitted to the air cleaning devices 11 to control the actuation operation through the wireless network cloud computing service module 21. The device management unit 23 receives the communication information of the plurality of air cleaning devices 11 through the wireless network cloud computing service module 21 to

manage the user login and device binding. The device management information can be provided to the application program unit 24 for system control and management, and the application program unit 24 can also display and inform the air pollution information obtained by the cloud control service unit 22. The user can know the real-time status of air pollution removal through the mobile phone or the communication device. Moreover, the user can control the operation of the indoor air cleaning system through the application program unit 24 of the mobile phone or the communication device. Certainly, the air cleaning system of the present disclosure includes a control drive software built into the central control and regulation device 12 and a mobile device. The control command is transmitted to the gas detection module 3 for receiving, so that the gas detection module 3 is allowed controlling the processing operations of the air cleaning device 11 to filter the air pollution. The mobile device issues the control command through wireless communication, the application program unit 24 of the networked computing service device 2 receives and then transmits the control command to the communication module 13 of the air pollution treatment device 1 for receiving, and the communication module 13 transmits the control command to the gas detection module 3 for receiving through wireless communication or wired communication, so that the processing operations of the air cleaning device 11 are controlled to filter the air pollution, and the gas state of the air pollution in the indoor field A reaches a clean room requirement of ZAPClean Room 1~9.

[0043] Moreover, in the indoor air cleaning system of the present disclosure, the networked cloud computing service device 2 receives the air pollution data of the indoor field A and the outdoor field B through the wireless communication or the wired communication for storing to form the big data database of the air pollution data. The intelligent computing

comparison based on the database of the air pollution data is performed to intelligently select and output the control command to the fan 111 of the air cleaning device 11 for actuation and regulation operation. Whereby, the fan 111 of the air cleaning device 11 generates an internal circulation directional airflow continuously in the indoor field A, and the air pollution is guided to pass through the filtering element 112 multiple times for filtration. In other words, the networked cloud computing service device 2 intelligently computes the cleanliness according to the number of suspended particles passing through the indoor field A in real time, intelligently selects and issues the control command to be transmitted to the plurality of the air cleaning devices 11, and timely adjusts and controls the fan 111 of the air cleaning device 11 for actuation, so as to randomly change and adjust the airflow volume and the actuation time period based on the cleanliness of the number of suspended particles in real time. Whereby, the cleaning efficiency of the indoor field A is improved, the environmental noise of the indoor field A is reduced, the internal circulation directional airflow is generated in the indoor field A to generate, and the air pollution is guided to pass through the filtering element 112 multiple times for filtration, so that the gas state of the air pollution in the indoor reaches the air pollution data targeted according to a cumulative number of PM2.5 detected by the plurality of gas detection modules 3 in 24 hours and a required space of the indoor field A for one air cleaning device 11, to meet a clean room requirement of ZAPClean Room 1~9.

[0044] The above clean room requirement allows to reach a cleanliness of ZAPClean Room 1~9, which is similar to the ISO standard clean room ISO 1~9. However, the cleanliness of ZAPClean Room 1~9 is a technical structure different from the traditional clean room ISO 1~9, but able to achieve the same indoor air cleanliness as the traditional clean room

ISO 1~9. Generally, the cleanliness of the traditional clean room ISO 1~9 is not equipped with sensors for real-time detection around the clock, so the system need to be operated in a 24-hour accumulation and high-speed mode. This way of operating will result in a large amount of energy loss and a high-noise environment. Such a system cannot be used in ordinary indoor home life.

[0045] The indoor air cleaning system of the present disclosure allows to reach the cleanliness of ZAPClean Room 1~9. The indoor air cleaning system of the present disclosure utilizes the plurality of air cleaning devices 11 with the gas detection module 3 and the networked cloud computing service device 2 disposed therein to form an intelligent linkage system. The external and build-in gas detection modules 3 are used to detect PM2.5 concentration/particle number, carbon dioxide (CO₂), carbon monoxide (CO), formaldehyde, methane, toluene, volatile organic compounds (TVOC), ozone (O₃), nitric oxide (NO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), radon (Rn-222), bacteria and fungi. It allows connecting to the networked cloud computing service device 2 through wired communication or wireless communication for intelligently computing and selecting so that the control instruction signals are provided for the gas detection modules 3 in the plurality of air cleaning devices 11 regulating the activation operations, the air volume and the noise level of the fan 111, thereby achieving the ZAPClean room system that operates silently and efficiently.

[0046] In specific examples of the present disclosure, as shown in FIG. 6, the air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 500,000 of PM2.5 inhaled suspended particles detected in 24 hours and a required indoor field space of 0.7 pings (i.e., 2.4 square meters, 25.6 square feet) for

one air cleaning device 11, and include detection of suspended particulate matter $PM_{2.5} \leq 0.02 \mu\text{g}/\text{m}^3$, detection of suspended particulate matter $PM_{10} \leq 0.03 \mu\text{g}/\text{m}^3$, detection of bacteria and fungi $\leq 2 \text{ CFU}/\text{m}^3$, detection of formaldehyde $\leq 0.032 \text{ ppm}$, detection of volatile organic compounds (TVOC) $\leq 0.24 \text{ ppm}$, detection of carbon dioxide $\leq 800 \text{ ppm}$, detection of carbon monoxide $\leq 4 \text{ ppm}$, detection of ozone $\leq 0.020 \text{ ppm}$, detection of methane $\leq 9 \text{ ppm}$, detection of toluene $\leq 43 \text{ ppm}$, detection of nitric oxide and nitrogen dioxide $\leq 0.043 \text{ ppm}$, detection of sulfur dioxide $\leq 0.032 \text{ ppm}$, detection of radon $\leq 40 \text{ Bq}/\text{m}^3$, for meeting the clean room requirement of ZAPClean Room 1.

[0047] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 1,000,000 of $PM_{2.5}$ inhaled suspended particles detected in 24 hours and a required indoor field space of 1 ping (i.e., 3.4 square meters, 36.6 square feet) for one air cleaning device 11, and include detection of suspended particulates $PM_{2.5} \leq 0.04 \mu\text{g}/\text{m}^3$, detection of suspended particulates $PM_{10} \leq 0.06 \mu\text{g}/\text{m}^3$, detection of bacteria and fungi $\leq 5 \text{ CFU}/\text{m}^3$, detection of formaldehyde $\leq 0.038 \text{ ppm}$, detection of volatile organic compounds (TVOC) $\leq 0.27 \text{ ppm}$, detection of carbon dioxide $\leq 800 \text{ ppm}$, detection of carbon monoxide $\leq 4 \text{ ppm}$, detection of ozone $\leq 0.025 \text{ ppm}$, detection of methane $\leq 10 \text{ ppm}$, detection of toluene $\leq 48 \text{ ppm}$, detection of nitric oxide and nitrogen dioxide $\leq 0.048 \text{ ppm}$, detection of sulfur dioxide $\leq 0.036 \text{ ppm}$, detection of radon $\leq 45 \text{ Bq}/\text{m}^3$, for meeting the clean room requirement of ZAPClean Room 2.

[0048] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of

2,500,000 of PM_{2.5} inhaled suspended particles detected in 24 hours and a required indoor field space of 1.5 pings (i.e., 4.9 square meters, 52.3 square feet) for one air cleaning device 11, and include detection of suspended particulate matter PM_{2.5} $\leq 0.11 \mu\text{g}/\text{m}^3$, detection of suspended particulate matter PM₁₀ $\leq 0.16 \mu\text{g}/\text{m}^3$, detection of bacteria and fungi $\leq 10 \text{ CFU}/\text{m}^3$, detection of formaldehyde $\leq 0.044 \text{ ppm}$, detection of volatile organic compounds (TVOC) $\leq 0.30 \text{ ppm}$, detection of carbon dioxide $\leq 800 \text{ ppm}$, detection of carbon monoxide $\leq 5 \text{ ppm}$, detection of ozone $\leq 0.030 \text{ ppm}$, detection of methane $\leq 11 \text{ ppm}$, detection of toluene $\leq 53 \text{ ppm}$, detection of nitric oxide and nitrogen dioxide $\leq 0.053 \text{ ppm}$, detection of sulfur dioxide $\leq 0.040 \text{ ppm}$, detection of radon $\leq 51 \text{ Bq}/\text{m}^3$, for meeting the clean room requirement of ZAPClean Room 3.

[0049] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 5,000,000 of PM_{2.5} inhaled suspended particles detected in 24 hours and a required indoor field space of 2 pings (i.e., 6.9 square meters, 74.7 square feet) for one air cleaning device 11, and include detection of suspended particulate matter PM_{2.5} $\leq 0.20 \mu\text{g}/\text{m}^3$, detection of suspended particulate matter PM₁₀ $\leq 0.32 \mu\text{g}/\text{m}^3$, detection of bacteria and fungi $\leq 30 \text{ CFU}/\text{m}^3$, detection of formaldehyde $\leq 0.05 \text{ ppm}$, detection of volatile organic compounds (TVOC) $\leq 0.33 \text{ ppm}$, detection of carbon dioxide $\leq 800 \text{ ppm}$, detection of carbon monoxide $\leq 5 \text{ ppm}$, detection of ozone $\leq 0.035 \text{ ppm}$, detection of methane $\leq 12 \text{ ppm}$, detection of toluene $\leq 59 \text{ ppm}$, detection of nitric oxide and nitrogen dioxide $\leq 0.059 \text{ ppm}$, detection of sulfur dioxide $\leq 0.044 \text{ ppm}$, detection of radon $\leq 57 \text{ Bq}/\text{m}^3$, for the clean room requirement of ZAPClean Room 4.

[0050] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 10,000,000 of PM_{2.5} inhaled suspended particles detected in 24 hours and a required indoor field space of 3 pings (i.e., 9.9 square meters, 106.8 square feet) for one air cleaning device 11, and include detection of suspended particles PM_{2.5} $\leq 0.4 \mu\text{g}/\text{m}^3$, detection of suspended particles PM₁₀ $\leq 0.64 \mu\text{g}/\text{m}^3$, detection of bacteria $\leq 80 \text{ CFU}/\text{m}^3$, detection of fungi $\leq 60 \text{ CFU}/\text{m}^3$, detection of formaldehyde $\leq 0.05 \text{ ppm}$, detection of volatile organic compounds (TVOC) $\leq 0.33 \text{ ppm}$, detection of carbon dioxide $\leq 800 \text{ ppm}$, detection of carbon monoxide $\leq 5 \text{ ppm}$, detection of ozone $\leq 0.035 \text{ ppm}$, detection of methane $\leq 12 \text{ ppm}$, detection of toluene $\leq 59 \text{ ppm}$, detection of nitric oxide and nitrogen dioxide $\leq 0.043 \text{ ppm}$, detection of sulfur dioxide $\leq 0.059 \text{ ppm}$, detection of radon $\leq 64 \text{ Bq}/\text{m}^3$, for the clean room requirement of ZAPClean Room 5.

[0051] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 25,000,000 of PM_{2.5} inhaled suspended particles detected in 24 hours and a required indoor field space of 5 pings (i.e., 16.5 square meters, 177.9 square feet) for one air cleaning device 11, and include detection of suspended particles PM_{2.5} $\leq 1.0 \mu\text{g}/\text{m}^3$, detection of suspended particles PM₁₀ $\leq 1.6 \mu\text{g}/\text{m}^3$, detection of bacteria $\leq 200 \text{ CFU}/\text{m}^3$, detection of fungi $\leq 150 \text{ CFU}/\text{m}^3$, detection of formaldehyde $\leq 0.056 \text{ ppm}$, detection of volatile organic compounds (TVOC) $\leq 0.37 \text{ ppm}$, detection of carbon dioxide $\leq 800 \text{ ppm}$, detection of carbon monoxide $\leq 6 \text{ ppm}$, detection of ozone $\leq 0.040 \text{ ppm}$, detection of methane $\leq 13 \text{ ppm}$, detection of toluene $\leq 66 \text{ ppm}$, detection of nitric oxide and nitrogen dioxide $\leq 0.066 \text{ ppm}$,

detection of sulfur dioxide (SO_2) ≤ 0.049 ppm, detection of radon ≤ 72 Bq/m³, for the clean room requirement of ZAPClean Room 6.

[0052] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 50,000,000 of PM_{2.5} inhaled suspended particles detected in 24 hours and a required indoor field space of 7 pings (i.e., 23.6 square meters, 254.2 square feet) for one air cleaning device 11, and include detection of suspended particles PM_{2.5} ≤ 2.1 $\mu\text{g}/\text{m}^3$, detection of suspended particles PM₁₀ ≤ 3.2 $\mu\text{g}/\text{m}^3$, detection of bacteria ≤ 500 CFU/m³, detection of fungi ≤ 350 CFU/m³, detect formaldehyde ≤ 0.068 ppm, detection of volatile organic compounds (TVOC) ≤ 0.45 ppm, detection of carbon dioxide ≤ 800 ppm, detection of carbon monoxide ≤ 7 ppm, detection of ozone ≤ 0.050 ppm, detection of methane ≤ 16 ppm, detection of toluene ≤ 81 ppm, detection of nitric oxide and nitrogen dioxide ≤ 0.081 ppm, detection of sulfur dioxide ≤ 0.061 ppm, detection of radon ≤ 81 Bq/m³, for the clean room requirement of ZAPClean Room 7.

[0053] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 100,000,000 of PM_{2.5} inhaled suspended particles detected in 24 hours and a required indoor field space of 10 pings (i.e., 33.7 square meters, 363.1 square feet) for one air cleaning device 11, and include detection of suspended particles PM_{2.5} ≤ 4.2 $\mu\text{g}/\text{m}^3$, detection of suspended particles PM₁₀ ≤ 6.4 $\mu\text{g}/\text{m}^3$, detection of bacteria ≤ 1000 CFU/m³, detection of fungi ≤ 750 CFU/m³, detection of formaldehyde ≤ 0.08 ppm, detection of volatile organic compounds (TVOC) ≤ 0.56 ppm, detection of carbon dioxide ≤ 1000 ppm, detection of carbon monoxide ≤ 8 ppm, detection of

ozone ≤ 0.055 ppm, detection of methane ≤ 18 ppm, detection of toluene ≤ 90 ppm, detection of nitric oxide and nitrogen dioxide ≤ 0.090 ppm, detection of sulfur dioxide (SO₂) ≤ 0.068 ppm, detection of radon ≤ 90 Bq/m³, for the clean room requirement of ZAPClean Room 8.

[0054] The air pollution data for the gas state of the air pollution in the indoor field A is targeted according to a cumulative number of 200,000,000 of PM_{2.5} inhaled suspended particles detected in 24 hours and a required indoor field space of 15 pings (i.e., 48.2 square meters, 518.7 square feet) for one air cleaning device 11, and include detection of suspended particles PM_{2.5} ≤ 8.5 $\mu\text{g}/\text{m}^3$, detection of suspended particles PM₁₀ ≤ 12.7 $\mu\text{g}/\text{m}^3$, detection of bacteria ≤ 1500 CFU/m³, detection of fungi ≤ 1000 CFU/m³, detection of formaldehyde ≤ 0.08 ppm, detection of volatile organic compounds (TVOC) ≤ 0.56 ppm, detection of carbon dioxide ≤ 1000 ppm, detection of carbon monoxide ≤ 9 detection of, detect ozone ≤ 0.06 ppm, detection of methane ≤ 20 ppm, detection of toluene ≤ 100 ppm, detection of nitric oxide and nitrogen dioxide ≤ 0.100 ppm, detection of sulfur dioxide ≤ 0.075 ppm, detection of radon ≤ 100 Bq/m³, for the clean room requirement of ZAPClean Room 9.

[0055] In summary, the present disclosure provides an indoor air cleaning system including an air cleaning device, a central control and regulation device and a communication module assembled into one piece for detecting, locating, circulating and filtering air pollution in an indoor field, and installed in the indoor field through a build-in or plug-in manner. The air cleaning device is combined with a gas detection module disposed therein for implementing air pollution detection to output air pollution data. Moreover, the central control and regulation device is configured to control

operations of the gas detection modules through a wired communication connection, and the gas detection module is configured to control the activation operation of the air cleaning device to filter the air pollution. A cloud computing service device receives the air pollution data through the wireless communication or the wired communication. Since the communication transmission can be achieved by using the wireless communication or the wired communication, the dual methods of the wired communication and the wireless communication are selected to implement an operable transmission communication mechanism. The intelligent computing comparison based on the database of the air pollution data is performed to intelligently select and output the control command. Then, the control command is transmitted to the gas detection module to regulate the activation operation of the air cleaning device through an operable transmission communication mechanism of the wired communication and the wireless communication. In that, the air pollution processing operation of the air cleaning device is controlled. Thereby, a gas state of the air pollution in the indoor field reaches a clean room requirement of ZAPClean Room 1~9. It avoids being exposed to hazardous gas in the environment that may cause the human health impacts and injuries. The present disclosure includes the industrial applicability and the inventive steps.

WHAT IS CLAIMED IS:

1. An indoor air cleaning system, comprising:

at least one air pollution treatment device, disposed in an indoor field, wherein the air pollution treatment device comprises an air cleaning device, a central control and regulation device and a communication module assembled into one piece for detecting, locating, circulating and filtering air pollution, wherein the air cleaning device comprises a gas detection module, the gas detection module detects the air pollution to generate air pollution data and transmit the air pollution data to the communication module for networking output, and the central control and regulation device is connected to the gas detection module through wired communication for regulating operations of the gas detection module, so that the gas detection module is allowed controlling processing operations of the air cleaning device to filter the air pollution; and

a networked cloud computing service device receiving the air pollution data through communication transmission, wherein the air pollution data are received and stored to form a big data database of the air pollution, and a control command is intelligently selected to be send based on intelligent calculation and comparison of the air pollution data, and transmitted to the gas detection module of the air pollution treatment device for receiving, so that the processing operations of the air cleaning device are controlled to filter the air pollution, and a gas state of the air pollution in the indoor field reaches a clean room requirement of ZAPClean Room 1~9.

2. The indoor air cleaning system according to claim 1, wherein the air cleaning device of the air pollution treatment device comprises a purifier, an air conditioner, a full heat exchanger and a dehumidifier integrated into one piece for detecting, locating, circulating and filtering the air pollution, and regulating temperature, humidity and ventilation of the indoor field.

3. The indoor air cleaning system according to claim 1, wherein the air cleaning device of the air pollution treatment device comprises a purifier, an air conditioner and a full heat exchanger integrated into one piece for detecting, locating, circulating and filtering the air pollution, and regulating temperature, humidity and ventilation of the indoor field.
4. The indoor air cleaning system according to claim 1, wherein the air cleaning device of the air pollution treatment device comprises a purifier and an air conditioner integrated into one piece for detecting, locating, circulating and filtering the air pollution, and regulating temperature, humidity and ventilation of the indoor field.
5. The indoor air cleaning system according to claim 1, wherein the air cleaning device of the air pollution treatment device comprises a purifier for detecting, locating, circulating and filtering the air pollution.
6. The indoor air cleaning system according to claim 1, wherein the air cleaning device of the air pollution treatment device is installed in the indoor field through a build-in manner.
7. The indoor air cleaning system according to claim 1, wherein the air cleaning device of the air pollution treatment device is installed in the indoor field through a plug-in manner.
8. The indoor air cleaning system according to claim 1, wherein the gas detection module comprises at least one power conversion component, at least one sensing component, at least one microcontroller (MCU), at least one wireless communication component (WI-FI) and at least one central control communication interface component.
9. The indoor air cleaning system according to claim 8, wherein the air cleaning device comprises a purifier, an air conditioner, a full heat exchanger and a dehumidifier arbitrarily integrated into one piece, and each of the purifier, the air conditioner, the full heat exchanger and the

dehumidifier comprises a fan, a filtering element, a driving control component and the gas detection module, wherein the gas detection module detects the air pollution to generate the air pollution data and transmit the air pollution data to the communication module for networking output, and the central control and regulation device is connected to the central control communication interface components of the purifier, the air conditioner, the full heat exchanger and the dehumidifier through wired communication to receive the air pollution data for displaying, wherein the gas detection module is connected under handshake communication protocol of wired communication or wireless communication to receive an control command issued by the networked cloud computing service device, calculates, processes and outputs a plurality of regulation signals to the driving control component, so that activation operation of the fan and a wind speed of the fan are regulated, and the fan is controlled to start guiding the air pollution passing through the filtering element for filtration.

10. The indoor air cleaning system according to claim 9, wherein the communication module of the air pollution treatment device communicates with the central control and regulation device and the wireless communication component (WI-FI) of the gas detection module of the air cleaning device through wireless communication to receive the air pollution data and then transmit to the networked cloud computing service device, and the air pollution information is received and stored to form the big data database of the air pollution.

11. The indoor air cleaning system according to claim 10, wherein the communication module is a router.

12. The indoor air cleaning system according to claim 10, wherein communication transmission of the communication module is a wired communication transmission or a wireless communication transmission.

13. The indoor air cleaning system according to claim 9, wherein the networked cloud computing service device intelligently computes and compares based on the air pollution data, wherein the control command is intelligently selected and issued through the communication module, transmitted to the gas detection module of the air cleaning device for receiving, then transmitted to the driving control component to regulate the activation operation of the fan and the wind speed of the fan, wherein the fan is controlled to start guiding the air pollution passing through the filtering element for filtration, therefore the gas state in the indoor field is cleaned to meet the clean room requirement of ZAPClean Room 1~9.

14. The indoor air cleaning system according to claim 9, wherein the networked cloud computing service device intelligently computes and compares based on the air pollution data, the control command is intelligently selected and issued to the at least one central control and regulation device through the communication module, and then the control command is transmitted to the gas detection module through wired communication connection for receiving, and then transmitted to the driving control component to regulate the activation operation of the fan and the wind speed of the fan, wherein the fan is controlled to start guiding the air pollution passing through the filtering element for filtration, so that the gas state in the indoor field is cleaned to meet the clean room requirement of ZAPClean Room 1~9.

15. The indoor air cleaning system according to claim 13 or 14, wherein the gas detection modules are connected under handshake communication protocol of wired communication or wireless communication, wherein when the wireless communication or the wired communication is disconnected, it allows to regulate and select an activation mechanism with the wired communication or the wireless communication that can operate

transmission, wherein the networked cloud computing service device receives the air pollution data through the activation mechanism with the wired communication or the wireless communication that can operate the transmission, intelligently computes and compares based on the air pollution data, and then intelligently selects and issues the control command to be transmitted to the gas detection modules for receiving under the connection of the activation mechanism with the wired communication or the wireless communication that can operate transmission, and then the control command is transmitted to the driving control component to regulate the activation operation of the fan and the wind speed of the fan, wherein the fan is controlled to start guiding the air pollution passing through the filtering element for filtration, so that the gas state in the indoor field is cleaned to meet the clean room requirement of ZAPClean Room 1~9.

16. The indoor air cleaning system according to claim 13 or 14, wherein the gas detection modules are connected under the handshake communication protocol of the wired communication or the wireless communication, wherein when the wireless communication and the wired communication are both disconnected, it allows to autonomously compute and compare the air pollution data outputted by the gas detection modules based on the air pollution data, and then transmit the control command to the driving control component to regulate the activation operation of the fan, wherein the fan is controlled to start guiding the air pollution passing through the filtering element for filtration, so that the gas state in the indoor field is cleaned to meet the clean room requirement of ZAPClean Room 1~9.

17. The indoor air cleaning system according to claim 9, wherein the filtering element is an ultra low particulate air (ULPA) filter, a high efficiency particulate air (HEPA) filter or a combination thereof.

18. The indoor air cleaning system according to claim 9, wherein the air cleaning device further comprises an ultraviolet lamp component, and the ultraviolet lamp component is arranged on one side of the filtering element for sterilizing the air pollution.

19. The indoor air cleaning system according to claim 1, wherein the networked cloud computing service device comprises a wireless network cloud computing service module, a cloud control service unit, a device management unit and an application program unit.

20. The indoor air cleaning system according to claim 19, further comprising a control drive software built into the central control and regulation device and a mobile device, wherein the control command is transmitted to the gas detection module for receiving, so that the gas detection module is allowed controlling the processing operations of the air cleaning device to filter the air pollution, wherein the mobile device issues the control command through wireless communication, the application program unit of the networked computing service device receives and then transmits the control command to the communication module of the air pollution treatment device for receiving, and the communication module transmits the control command to the gas detection module for receiving through wireless communication or wired communication, so that the processing operations of the air cleaning device are controlled to filter the air pollution, and the gas state of the air pollution in the indoor field reaches the clean room requirement of ZAPClean Room 1~9.