

Air Disinfection Robot

PRODUCT MANUAL



Dear customers:

Thank you very much for purchasing and using the air disinfection robot developed and manufactured by GFAI. Now robots have been widely used in various places such as hospitals, schools, hotels, office buildings, factories and supermarkets. I hope its arrival will help you more and bring you a smarter experience.

For using the robot correctly and quickly, please read this Manual carefully before operation, and keep it properly for reference when necessary.

Please contact us to solve the problems you encounter during use. We will arrange professionals to answer you. The pictures, diagrams and other data in this Manual are for reference only. Due to the difference in software and hardware versions, please refer to the version you have received actually for details. Please consult us in time if you have any doubts.

Solemn statement:

The trademarks and icons used in this Manual are owned by our company and protected by national laws and international conventions.

This Manual is only applicable to the description on the operation of this model of product, as well as its operating conditions and environmental requirements.

All copyrights of this Manual belong to GFAI.

GFAI reserves the right of final interpretation of this Manual.

If you do not raise any written objections to this Manual, you will be deemed to have accepted the above terms.

Disclaimer:

The Company will not assume any responsibility for damage to the robot body and equipment and personal injury caused due to the use and operation of the robot in violation of the requirements of this Manual.

The Company does not assume any responsibility for the infringements and robot damage caused due to the installation of third-party services that are not approved by the company and the use of the information published by the robot management platform by user.

Terms on rights protection:

You need to obtain the permission from GFAI before selling the robots manufactured by the Company or any associated software or its derivative products, or modifying finished products or copying and creating the derivative products of robots and software. It is not allowed to copy, modify, adapt, translate, call interface, decompile, decompose or try to derive source code from GFAI software without the written permission of GFAI.

In addition, you cannot use the robot and its derivatives in a way that may cause damage, disabling, overload or degradation of GFAI's services, or use the product in a way that will affect the use by any third party.

Please contact us if you have any questions on GFAI products.

Limitation of liability:

GFAI is not responsible for the losses caused due to the misuse of robot products or supporting software by user.

Such limitation of liability applies to prevent the compensation for direct, indirect, accidental, incidental, special or punitive damages, regardless of whether such a statement is based on a guarantee, contract, infringement or other reasons (including negligence), even if the proposal on the possibility of such losses has been submitted to GFAI or third-party software suppliers. It applies to the damages caused due to the use, misuse or reliance on robot software and the products or services that can be used together with or in the robot software, or the damages caused due to the inability to use robot software or the products or services that can be used together with or in the robot software or the damages caused to the interruption, suspension or termination of robot software or the products or services that can be used together with or in the robot software.

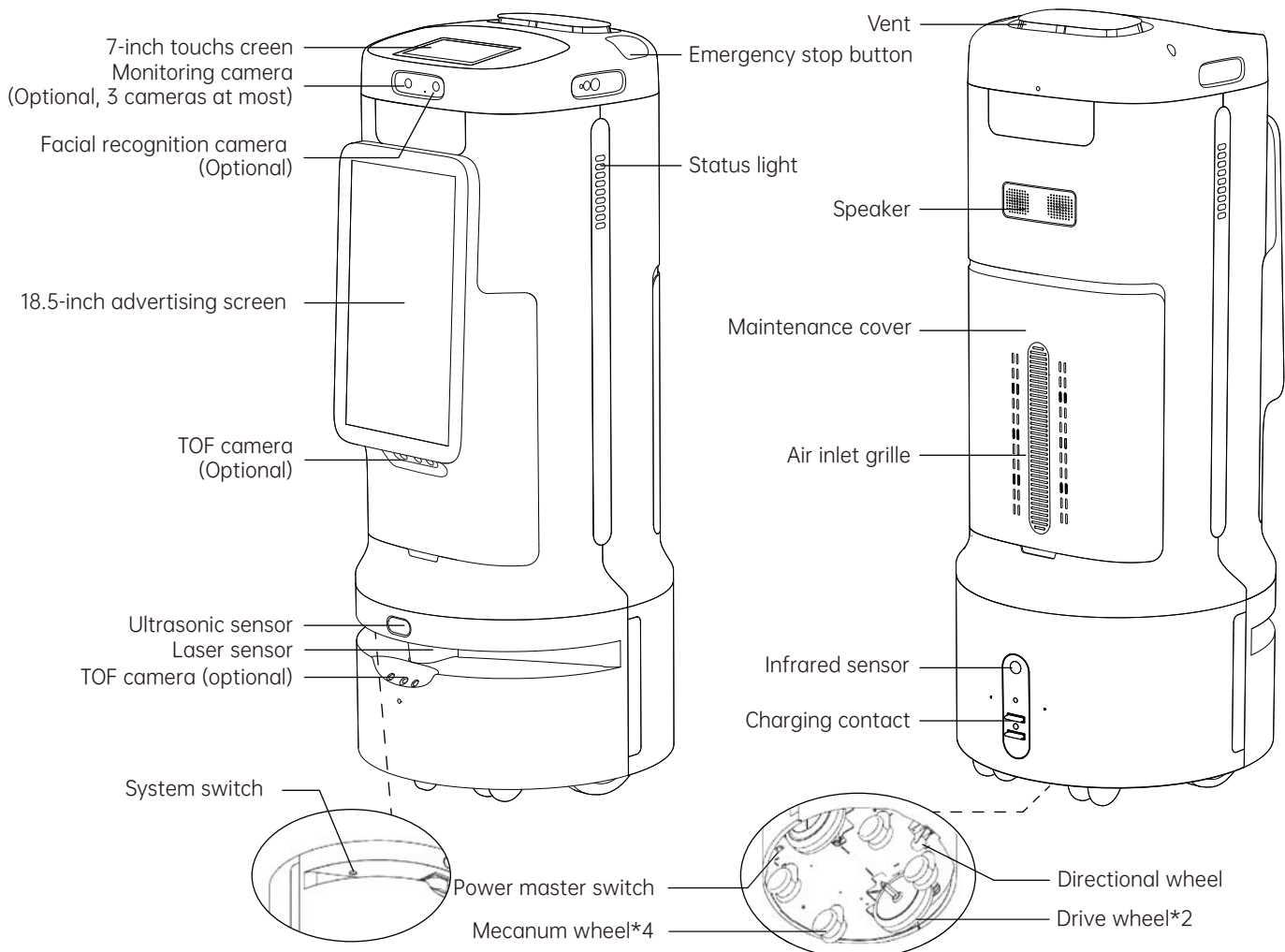
Such limitation of liability will apply to the maximum extent permitted by law, even if any limited remedy measures fail to achieve its basic purpose.

1 PRODUCT INTRODUCTION

1.1 Product Overview

Air disinfection robot realizes smart sterilization of spaces with the combined use of SLAM and photocatalytic sterilization technology. It performs pure natural and green sterilization with hydroxyl radicals, which are constantly released. The hydroxyl radicals actively look for pathogens through physical motion of airflow. They kill pathogenic microorganisms dependent upon their strong oxidation capabilities, decomposed into water and carbon dioxide. Compared with traditional sterilization methods such as ultraviolet lamp, ozone, plasma and anion, this robot only releases ozone at $0.003\text{mg}/\text{m}^3$, which is far below the national limit ($0.1\text{mg}/\text{m}^3$), so it perfectly makes human-machine symbiosis possible. Able to run and charge by itself, the robot can locally or remotely upload information on its running, operation and task in real time. A user can assign sterilization tasks so that the robot will actively, efficiently and accurately perform sterilization. Widely used in hospitals, schools, hotels, office buildings, factories and supermarkets, the air disinfection robot effectively improves sterilization efficiency and guarantees public health security of spaces.

1.2 Product Appearance



1.3 Product Parameters

Basic parameters	Overall dimension	500mm×500mm×1195mm
	Package dimension	620mm×620mm×1500mm
	Net weight	65kg
	Gross weight	77kg
	Operating system	Android 7.1
	Touch screen	7-inch; resolution: 1024×600
	Display screen	18.5-inch, resolution: 768×1366
	CPU	RK3288
	RAM	2GB
	ROM	8GB
	Network	4G/WIFI
	Battery capacity	24V, 20Ah
	Working hours	4.5h
	Charging time	4.5h
	Standby time	15.5h
	Speaker	2
	Noise	≤60dB (work normally in case of no broadcast)
Environment	Operating environment	Temperature: 5°C~45°C; humidity: 5% ~ 85%
	Storage environment	Temperature: -10°C~60°C; humidity: 5% ~ 85%
Chassis parameters	Mapped area	≤10000m ²
	Applicable area	≤1000m ² (calculated based on 4m floor height)
	Movement speed	0~0.8m/s (user-defined)
	Width of driving passage	≥800mm
	Sensor	Single-line laser, RGBD TOF camera (optional), ultra-sonic, 6-axis gyroscope
	Width of surmountable trench	≤40mm
	Climbability	≤5°
	Height of surmountable obstacle	≤10mm
	Minimum turning radius	0
	Maximum rotational speed	60°/s
	Positioning accuracy	±5cm
	Wheels	2 differential wheels + 4 mecanum wheels + 1 auxiliary directional wheel
Parameters of charging piles	Charging mode	Automatic recharging by contact
	Input	AC110-240V
	Output	29.4V, 7A

Sterilization parameters	Sterilization efficiency	For 2 hours of operation inside a 20m ³ experimental cabin, the kill rate of staphylococcus albus (type: 8032) is higher than 99.9%; the kill rate exceeds 90% inside an experimental cabin with a volume below 100m ³ .
	UV leak	< 1uw/cm ²
	Produced ions	Hydroxyl ions
	Applicable sterilization material	Sabinene oxide solution
	Volume of material box	4000mL (replaced after use for 500 to 660h)

2 PRECAUTIONS

You are welcome to use the air disinfection robot. Please check and confirm the following items before using the robot

2.1 List of accessories

No.	Name	Qty.	Unit
1	Robot packing	1	Set
2	Air disinfection robot	1	Unit
3	Power cord	1	pcs
4	Charging pile	1	Unit
5	Warning sticker on charging pile	1	pcs
6	Shipping list	1	pcs
7	Certificate	1	pcs
8	Warranty card	1	pcs

2.2 Safety requirements for operation

- (1) Please use the robot within the temperature range from 5°C to 45°C, and store it and its accessories within the temperature range from -10°C to 60°C.
- (2) Do not use it immediately after a great temperature change (for example, when it is moved from a cold outdoor place to a warm indoor place).
- (3) Do not use it in dusty, damp, rainy or dirty places close to magnetic fields.
- (4) Do not use it in an environment that is flammable, explosive or close to a heat source.
- (5) Do not place it in direct sunlight for a long time.

- (6) The ground of the area where the robot is operating should be solid, smooth and level. The robot should not be used on carpets (Higher than 15 mm), soft and ditched ground, outdoor places and other similar places, otherwise, its performance may be reduced or it may fall down.
- (7) Since the robot can move and complete various actions by itself, please pay special attention: do not move it on a sloped ground (More than 5°) to avoid personnel injury or damage to robot and equipment, facility and article due to the accidental falling or uncontrolled operation of robot. Please specially arrange persons for supervision when it is moving on a road with slope.
- (8) Be careful of the position with stairs or steps, and prevent the robot from moving in this area to prevent tripping or falling.
- (9) When operating the robot in the area close to all-glass doors and all-glass walls, please stick visual safety signs at the position of glass which is 22cm-25cm above the ground. People (especially children) should keep a safe distance from the robot (1 meter or more) to prevent personal injury or robot damage caused during operation of robot.
- (10) Sufficient movement space should be provided for the robot to prevent causing damage to the robot or surrounding objects due to the collision with surrounding objects.
- (11) Do not fall, drop, squeeze, bend, puncture, cut, microwave, incinerate or paint the robot and its components.
- (12) Do not try to disassemble the robot and its accessories. Only the professionals with authorization are allowed to conduct the disassembly operation.
- (13) Do not apply excessive pressure on the screen and the device to avoid damage.
- (14) In order to ensure the reliability of this product and the safety of operation, please use the special accessories of this robot.

- **Battery maintenance:**

- 1. During the transportation and storage, 45% of battery power should be kept. It should be stored in a cool and dry place and kept away from heat sources.**

- 2. When the battery is not used for a long time, charge and discharge it at least once every three months.**

2.3 Precautions for the use of charging piles and batteries

- (1) Please charge the robot with the original AC power cord and charging pile provided along with the robot.
- (2) Please use a power supply with proper grounding that complies with local laws and regulations and the requirements of this Manual, otherwise, people may get an electric shock and the robot may be damaged.
- (3) Do not drop or hit the charging pile.
- (4) Do not touch the power cord with wet hands, or remove the charging pile by means of pulling the power cord.
- (5) Protect the charging pile from rain, liquid and damp.
- (6) If the robot is not used for a long time, please charge it once every 15 days or so, so as to ensure that the battery is always in the state of best activity.
- (7) Do not use the battery for other equipment.
- (8) Do not try to touch the charging pile and the output end of charging port of the robot, otherwise, there may be certain risks.
- (9) The area where the charging pile is deployed must be against the wall and be open within a radius of 2 meters.

- **Note: The indicator light of the charging pile will be on in two colors only as follows:**

- Red: The charging pile has been electrified, but unconnected to equipment for charging.**

- Green: The charging pile has been electrified and connected to equipment for charging.**

 **Special note: Improper operation of battery may cause accidents such as battery explosion, fire, liquid leakage and corrosion.**

3 ENVIRONMENTAL SURVEY

The use site of robot is only an indoor environment with a flat layer and no drop. In view of the situation that the sensor has blind area and different materials will interfere with the sensor to some extent, the scenes that the equipment can operate the stably and the dangerous scenes are listed below. Before the equipment enters the site, it is necessary to determine whether it is suitable for equipment operation through corresponding surveys.

- (1) The equipment can only be operated in an indoor environment.
- (2) The operation site mustn't have drop, and there is no height difference of more than 10mm on the same plane in the environment.
- (3) If there is slope in the operation site, it must be within the range of the specification value. In addition, it is not recommended to deploy points near ramps.
- (4) When there are a lot of glass in the use environment, such as: glass walls, glass doors, etc., the shielding stickers provided by our company should be pasted at the lidar height of the glass environment.
- (5) If there are frequent decorations or environmental changes in the operation site, the map should be rebuilt in time to avoid the risk of map offset during equipment operation (the risk areas include but are not limited to: fire stairs, leveling stairs, small steps, and escalators).

3.1 Risk of Falling

- (1) When a site has a drop that is 10mm lower than the ground or in a non-planar environment, there will be a risk of falling and overturning when the equipment is moving.
- (2) When deploying in a site with a risk of falling, environmental safety judgments should be made in accordance with the Survey Specification for Deployment of Self-developed Chassis, and statistics should be reported through the Basic Leveling Deployment Survey Document.

3.2 Network Communication

- (1) Simply check whether there is a blind spot in the network signal of the mobile phone card on the spot. If the mobile robot is in the signal area, it may cause the machine to go offline.
- (2) If Wi-Fi is available on site, check whether it is necessary to connect to an account or obtain a verification code. If this is the case, it may cause the machine to fail to verify and go offline.

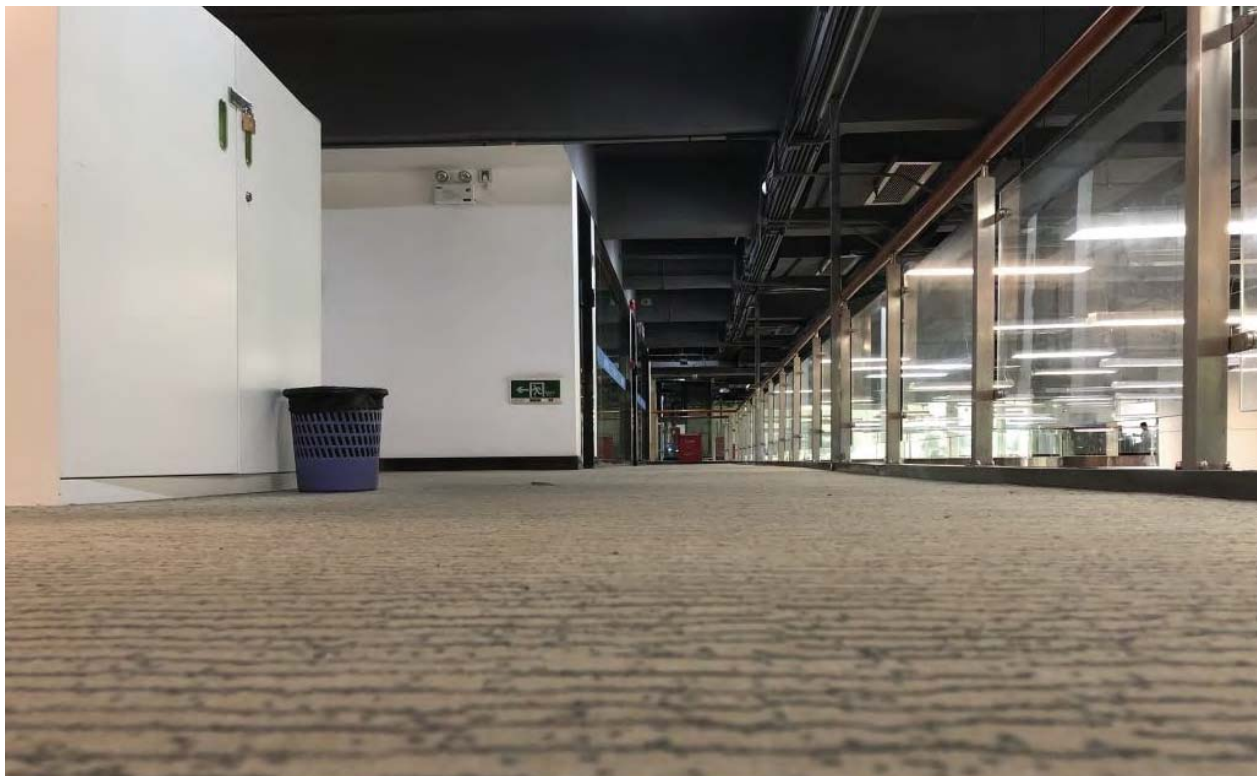
3.3 Deployment Area

- (1) Deployment area: The deployment area should be smaller than the device mapped area.
- (2) Check whether the on-site environment has fenced decoration, because the scene change requires rebuilding the map. Therefore, if there is a fenced area, you need to inform the client clearly in advance(as shown below).



3.4 Ground Type

- (1) Fill in according to the type of on-site ground (as shown below).



3.5 Ground Survey

(1) Check whether the ground contains any landmark light. If the landmark light is too high, the machine may shake(as shown below).



(2) Check whether there are too many temporary obstacles on the ground, as this will cause the machine to shift(as shown below).



(3) Check whether there are downward, upward steps or stairs in the environment. This item is very important as the machine may fall over if there are downward stairs or steps, where it is generally not recommended to deploy(as shown below).



(4) Check whether there is continuous large glass in the operating environment. If yes, it needs to be filmed, or else the safety of the machine can't be guaranteed(as shown below).



(5) Check whether there are steps with a height difference greater than or equal to 10mm or slopes greater than 5° in the environment. There are risks in the operation of machines in such environment, and deployment is not recommended(as shown below).



(5) Check whether there is any normally open or normally closed safety door in the environment. Generally, there are upward and downward stairs inside the safety door, which is also an area with a risk of falling(as shown below)



(7) Check whether there are pits and ridges with a height difference greater than or equal to 10mm in the environment (as show below).



3.6 Carpet Type

If there is any carpet, it is necessary to check its material and thickness. Too thickness carpet will cause height difference between the charging contacts of the robot and charging pile, resulting in the inability to align or return to the charging pile(as shown below).



3.7 Corridor

Check the minimum width of the corridor front, back, left, and right(as shown below).



3.8 Risk of Falling

When there is a falling environment, it is not recommended to move the equipment on site if it is not equipped with a top-view camera. When a top-view camera is installed, environmental surveys must also be carried out in accordance with section 2 and reported.

- (1) Stairs (downward), escalators (upward and downward).
- (2) Steps with a drop of 10mm or more.
- (3) Environment with high slope (above 5°, non-friction ground slope) or high ridge (above 10mm).
- (4) Fire safety passage (normally open/normally closed door): behind the door there are falling environment and fire stairs.

3.9 Map Offset Risk

You need to set a security threshold during deployment. After the map building, let the robot walk around of the working area and check the matching value. Set the security threshold to the lowest value of the circle below 10% for Movement.

Environmental reasons:

- (1) When there is a carpet with a thickness of more than 0.5cm in the on-site operating environment, there is a greater probability that the map will shift.
- (2) When used in an icy, frosty, or slippery environment, there is a greater probability that the map will shift.
- (3) When the operation site is open in a large area, and move in the area with no reference object that exceeds the laser recognition range, there is a probability that the map will shift.
- (4) The environment in the operating site has change significantly compared with the last time the map was created: such as re-decoration, if the map is not rebuilt after the layout change, there is a greater probability that the equipment map will shift.
- (5) Operation in the complex venues: If there are many mobile table and chairs in the office and frequent changes are made, there is a greater probability that the equipment map will shift.
- (6) When the site environment has slopes, ridges, or ditches, and the equipment speed is fast, there is a greater probability that the equipment map will shift.
- (7) Obstacles can't be recognized by the sensor when moving: If the top-view camera is not installed, there are obstacles that are higher than the ground and lower than 23cm and cause bumps and scratches, there is a greater probability that the equipment map will shift.
- (8) It needs to be started on the charging pile or contact the charging pile before formal use.

Operational reasons:

- (1) When correcting the position with wrong tool or interface, there is a greater probability that the equipment map will shift.
- (2) After the equipment is turned off, it is pushed to another location, and it is not turned on in the charging state.
- (3) The equipment is charged/ turned on at the charging pile, but the position of the charging pile does not match the actual position.
- (4) The wheels move off the ground when the equipment is turned on.
- (5) Push and drag the equipment for a long time to move when it is not in emergency stop after being turned on

3.10 Risk of Collision

- (1) No top-view camera installed: Obstacles 23cm below the ground. Top-view camera installed: Obstacles 8cm below the ground.
- (2) Objects with reflective, light-absorbing, and transparent materials.
- (3) Objects with visible volume less than 2cm or protrusions less than 2cm.
- (4) When the overall height of the equipment is over 1.1m and no additional configuration is made, it may collide with objects higher than 1.1m and lower than the height of the equipment.

3.11 Marking in the Map

- (1) The virtual wall must be calibrated inside the site where the equipment does not enter in order to avoid accidental entry.
- (2) If the map building range is larger than the actual operating range of the equipment, try to make the virtual walls enclose the actual operating range to avoid excessive movement of the equipment due to map offset.
- (3) If there is a dangerous area, the virtual walls should be at least 0.5m away from the dangerous area.
- (4) If the object is actually in the scene and the radar can scan it, but the part is missed in the actual scan, it needs to be complemented with the forbidden area.
- (5) In the glass environment, such as: glass wall, glass door, etc., the area needs to be marked with virtual walls.
- (6) At a three-dimensional obstacle higher than the scanning height of the radar, the area needs to be marked with virtual walls.
- (7) At low obstacles, such as ridges, pits and carpet areas that do not meet the performance parameters of the chassis, the area needs to be marked with virtual walls.
- (8) Strong light interference area: if the surrounding lights is particularly strong.

4 PRECAUTIONS FOR MOVEMENT

- (1) Flatness requirements: The road for robot should be smooth and free of bumps, steps and corners.
- (2) Slope: The robot should move on the ground with a slope less than 5° to avoid the risk of overturn.
- (3) Joint: Avoid joints (grooves should be less than 40mm) in the walking path of robot as far as possible, and wider joints should be treated with cover panels.
- (4) Load-bearing capacity of ground: The load per unit area of ground must be higher than the load per unit area in the horizontal projection area of robot, and the stress generated by the robot while walking on the ground should be effectively transmitted to the load-bearing layer.
- (5) Friction coefficient of ground: The friction coefficient of ground should not be less than 0.5, to ensure safe braking distance and positioning accuracy.
- (6) Requirements for cleanliness of ground: There should be no slipping liquids such as water spots and oil stains on the ground, to prevent the robot from slipping and thus affecting its operation. The road surface within the walking path of robot must be kept clean, and there should be no debris or obstacles that may prevent the driving wheels from passing smoothly.
- (7) Avoid objects that are too low or suspended in the forward direction, because they may affect the detection function of laser sensor and other devices.

5 ROUTINE MAINTENANCE

5.1 Maintenance of robot

- (1) The surface of robot shell should be protected from collision, scratching by hard object, impact and washing with a lot of water.
- (2) Only clean the surface with a soft damp cloth.
- (3) The working environment of charger should be dry and clean.

6 INSTRUCTIONS FOR REPLACEMENT AND CLEANING OF CONSUMABLES

6.1 Use of consumables

Wear anti-corrosion gloves and take out the hydroxy consumables of disinfection robot; keep the consumables upright and place them on a surface flat; open the consumable packaging, take out the consumables, unscrew the caps and avoid skin contact with the guide pillars on the top of consumables.

Open the consumables chamber door, press the consumables and install the springs so that the consumables are parallel to the consumables chamber door; gently push the consumables into the consumables chamber door, release the top of consumables, and the consumables will lightly enter the consumable chamber. Consumables should be installed on both sides, and there is no difference between the consumables on the left and right.

Close the consumables chamber door and prevent non-professionals from taking them out when the machine is running.

Connect to the power supply, and the disinfection robot will start to run. When the disinfection indicator in the interface lights up, it indicates that the disinfection robot works normally.

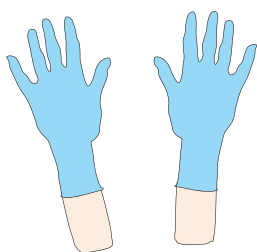
6.2 Replacement of consumables

The consumables should be replaced as soon as possible after they are exhausted. Please purchase the consumables designated by qualified dealers.

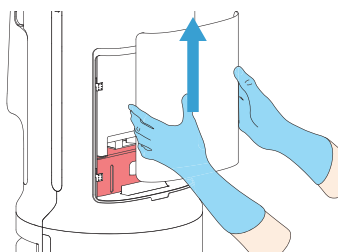
Turn off the disinfection robot and disconnect the power supply; open the consumables chamber door, wear protective gloves, press the buckle with a hand and lightly pull out the consumables; if you push the consumables too hard, the consumable chamber may be damaged, and thus the disinfection robot may fail to work normally.

Pack the replaced consumables with anti-corrosion plastic bags and discard them in special or chemical waste for disposal.

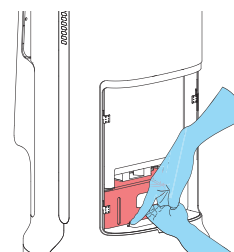
Caution: In case of contact with skin accidentally, please rinse with clean water repeatedly until the skin is no longer white; slight burning pain is normal and the skin will return to normal within 2 hours, so there is no need to be nervous.



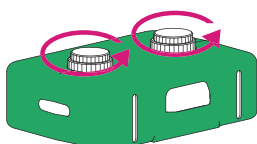
(1) Wear protective gloves.



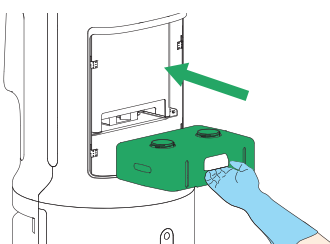
(2) Move the rear cover up and remove it.



(3) Press the buckle with left hand and pull out the consumables with right hand.



(4) Unscrew the caps of new consumables.



(5) Put the new consumables into the chamber and close the rear cover.

6.3 Cleaning and maintenance of consumables chamber

In order to keep a good disinfection effect, it is necessary to maintain the product after the robot runs for a long time. The maintenance cycle is 3 months.

During maintenance, replace the deionized water in the consumables chamber and clean the chamber.

The best service life of deionized water in the consumables chamber is less than 3 months. It is recommended to replace the deionized water when it expires so as to ensure the disinfection effect.

7 COMMON FAULTS AND CONTACT INFORMATION FOR AFTER-SALES SERVICES

Security thresholds need to be set when deploying. After the map is built and repaired, the robot is allowed to walk around and detect the matching value. The security threshold needs to be 10% lower than the matching value.

7.1 Common faults and solutions

Simple and non-technical solutions are shown below. Please contact the after-sales service hotline below if the fault cannot be removed in the following manner.

Start fault:

- (1) Check whether the robot has been turned on, and whether the main power switch at the chassis of robot has been turned off. If the main power switch has been turned off, please turn it on to start the robot normally;
- (2) If the power switch has been turned on but the robot cannot be started, the battery of robot may have run down, please return the robot to the charging pile for charging.

Failure to operate according to the set route

- (1) Check whether there are major layout changes in the operating environment of robot;

The robot is able to judge its position by recognizing the feature values of objects in the environment in the process of automatic navigation. Therefore, the robot is unable to position correctly when the environment changes greatly, and a new map needs to be built for the robot at this time.

- (2) Check whether the position of the charging pile of robot has been moved;
The robot needs to calibrate the map based on the position of charging pile. If the position of charging pile is moved, it needs to be recalibrated at the configuration page of chassis.

Control failure

- (1) The network signal is too poor, please check the network status of the environment where the robot is located;
- (2) If the chassis system of robot fails, please contact after-sales technical support.

Failure to walk normally

- (1) The power is low, please push the robot back to the charging pile for charging;
- (2) Robot network fails, and it is unable to connect to the Internet normally;
- (3) If the chassis of robot fails, please contact after-sales technical support;

Charging failure

Park the robot on the charging pile again, check whether the charger is in normal state: the power indicator turns red (the power is on, but no robot is connected), or it is flashing in green (the robot is being charged); if the robot still cannot be charged, please contact after-sales technical support.

The robot cannot perform sterilization

1. Check if the disinfectant of the robot has been used up. When the disinfectant is used up, the robot will enable its function of self-protection and suspend sterilization. In this case, you only need to replace the disinfectant of the robot. Then, the robot will resume normal sterilization.
2. Inspect the robot by itself, and contact us for aftersales services in case of any anomaly.

7.2 Contact information for after-sales services

If you need maintenance or repair services, please contact our maintenance service agency for corresponding free or paid services according to the service policy.

FCC compliance statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Important: Changes or modifications to this product not authorized by Shenzhen CIOT Robotics Co., Ltd could void the electromagnetic compatibility (EMC) and wireless compliance and negate your authority to operate the product.

This product has demonstrated EMC compliance under conditions that included the use of compliant peripheral devices and shielded cables between system components. It is important that you use compliant peripheral devices and shielded cables between system components to reduce the possibility of causing interference to radios, televisions, and other electronic devices.

RF Exposure Statement:

To maintain compliance with FCC's RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 20cm the radiator your body.

Use only the supplied antenna.

FCC ID: 2A5WH-ME1253C001F0