

# MP01-SA, the inspection operation robot



# 1. Product introduction

MP01-SA inspection robot system integrates ontology operation system, background management platform and remote control, and realizes the independent inspection of unattended scenes. The functions can include temperature measurement, photo uploading, target detection and switch cabinet door, button operation, etc. Through the network for remote control, the product can replace the manual, to achieve routine inspection and special inspection.

The system is based on robot body, based on trackless navigation technology and four-wheel drive chassis; including safety protection unit, drive unit, power supply unit, main control unit, communication unit, navigation unit, pickup intercom unit and other modules, which has the advantages of trackless, deployable, intelligent, cluster and long-time operation.

The robot can mainly perform fixed-point path inspection, designated point inspection operation, remote control inspection operation, high-definition visible light and infrared real-time video monitoring, recording, infrared temperature measurement and other functions, and replace the manual inspection task in the unattended environment.

## 2. Product function description

The inspection robot has the ability of walking, observing and recording, and can execute basic instructions such as "go to xx place", "observe objects" of xx ", "record xx data "and" operate on xx ". The combination of these functional units gives the robot a rich operation ability, so that it can replace or partially replace the inspection personnel to automatically perform all kinds of inspection operation tasks.

The robot can perform example patrol, special patrol, manual operation, one-button return tasks, complete automatic navigation walking, visible light photography, infrared photography, voice print acquisition, video recording, claw clip operation. Combined with our code-free control system, the robot can easily realize the above functions for different sites. According to the demand of unmanned operation, the functions of low-power automatic charging, self-inspection of the system module, obstacle avoidance in the listed area, and offline operation are developed. With the own lighting system, it can work at night. Good protection level, to the wind, frost, rain and snow weather has a certain ability to resist. It has the functions of climbing, wading, crossing ditch and avoiding collision to ensure stable and reliable all-weather unmanned operation.

### motor function

## **1) Laser navigation and positioning**

Robot using 3d laser navigation mode, using the process is: through the field deployment for station 3 d point cloud map, artificial set path and virtual track, specify the robot to a system coordinates robot according to the current coordinates, target coordinates and virtual track automatically generate navigation path, automatically walk along the path to the specified coordinates and stop at the specified location.

## **2) Road condition detection and safe driving**

The robot obtains local road conditions through the road condition sensing sensor to automatically prevent dangerous actions.

Collision: robot through ultrasonic distance for the distance of obstacles ahead, when obstacles higher than 300mm, less than 0.5m when the robot began to slow down, 250mm obstacles robot stop movement, obstacles removed can be restored after walking, if the distance measuring sensor detection failure, robot contact with obstacles, do secondary protection, safety touch safety for flexible hollow

The rubber material, with the buffer function, at the same time in contact with obstacles to the robot to stop instructions, forcing the robot to stop moving.

Anti-fall: the robot detects whether there are pits in front of the wheel through the geodesic sensor. When the height of the pits is greater than 80mm, the robot immediately stops moving to prevent falling.

### **3) Shortest path selection**

When the robot performs the "go to the xx location" instruction, it can automatically find the shortest path according to the virtual map.

### **4) one key**

The system end issues the "one-button return" command, and the robot immediately returns to the robot workstation.

### **5) Task interruption and recovery**

The robot has a task execution log, which can automatically record the execution process of each example patrol, special patrol and other tasks, and then support the project switch of example patrol, special patrol and manual remote control mode. After the switch, it can automatically recover the original interrupted tasks and continue to execute.

### **6) Network interruption works offline**

After the robot is disconnected from the on-site server network, the robot continues to perform the task according to the pre-set walking route and inspection points, and saves the task data after the network disconnection in the ontology. After the network is restored, the disconnected task data will be automatically uploaded to the system end.

### **7) Automatic charging**

When the robot power is lower than the set threshold, it will automatically return to the robot workstation for charging.

### **8) Manual remote control**

Artificial remote control function is mainly used for robot transfer, deployment and exception handling. Remote control instructions can be controlled from the system end under the interface

Hair, can also be used with the standard handle connection robot for remote control.

## **Image, infrared, and voice print acquisition**

The operation tools of the inspection robot can include light camera, infrared thermal imager and directional pickup.

## **Body self-test and alarm**

Visible light camera is used to take visible light images. It is equipped with zoom lens and automatic aperture, which can adapt to near and far distance and strong and weak light conditions, and come with white light fill light for shooting in dim environment.

The infrared thermal imager can take the infrared heat map of the area to obtain the overall temperature distribution of the device, and can also obtain the local area temperature and the highest temperature of the device through the thermal image.

The directional pickup can record the objects within 5m, and the recording file can be transmitted to the system end for voice print analysis.

## **Talk about propaganda**

The robot is integrated with the intercom system, which can carry out two-way voice transmission. After starting the intercom function, the system end can talk with the people near the robot through the headset.

## **Body self-test and alarm**

The inspection robot has the function of self-inspection. The three methods can determine whether each component is normal through communication detection, current detection and parameter detection, and the self-inspection information is reported to the system end. When abnormal key components such as remote control telemetry, battery module, drive module, detection equipment are detected, the robot will issue a sound and light alarm.

## Ontology parameter configuration

The parameters of the robot can be configured through the system end, including the maximum running speed of the robot, the obstacle detection distance, etc.

## environmental monitoring

A micro weather station can be set up on the robot, which can obtain PM 2.5, carbon monoxide, temperature and humidity data.

## heat-removal system

Adopt axial flow waterproof filter fan to isolate dust without affecting gas circulation; ensure the timeliness of gas data collection; and ensure all-weather high temperature and high strength operation.

## Hardware standard

The shell protection class shall meet the requirements of IP55 specified in GB 4208; withstand the electrostatic discharge immunity test of level 4 specified in GB / T 17626.2;

RF electromagnetic field radiation immunity test of harsh grade 2 specified in GB / T 17626.3;

Ab low temperature test under GB / T 2423.1 specified temperature-25°C, duration of 2h;

Bb high temperature test of 50°C under the temperature specified by GB / T 2423.2 and duration of 2h;

The vibration response and vibration durability test of grade I for the harsh grade specified in GB / T 11287.

## Performance parameter table

	order	Indicator type	Index requirements
batholith	1	Drive form	4 Wheel drive

	4	load capacity	150kg
	5	maximum speed	1.5m/s
	6	Vertical crossing, the barrier height	50mm
	7	Across the ditch ability	50mm
	8	turning radius	pivot steering
	9	Side slope Angle	15°

	10	climbing capacity	15°
	12	Repeat the localization error	$\leq \pm 10\text{mm}$
	13	duration of flight	8h
	14	levels of protection	IP 55
	15	Wireless remote control	Wifi /4g
	16	control method	Computer client
	17	charging interval	$\leq 2\text{h}$
arm	18	End load	3kg
	19	levels of protection	IP 54
	20	Terminal line speed	$\leq 1\text{m/s}$
	22	armspan	630mm
	23	End of the work, business scope	0m -1.2m
Camera (Optional)	24	visible light	1920x1080
	25	Double	30 Fold
	26	infrared	640x 512
Gas detection (optional)	27	C O	0~500pp m ; $\pm 5\%$
	28	O 2	0~30%Vo l ; $\pm 1\%$
	29	H 2S	0~200pp m ; $\pm 5\%$
	30	CH 4	0~100%LEL; $\pm 5\%$
humiture	31	Temperature detection	-40°C~60°C; $\leq \pm 0.5^\circ\text{C}$
	32	humidity examination	0-100%RH; $\leq \pm 2\% \text{ RH}$



### 3. Standard, quasi-accessories

#### charging pile

Ensure that the robot is stable and reliable, all-weather unmanned operation.



Photo: Autonomous charging device

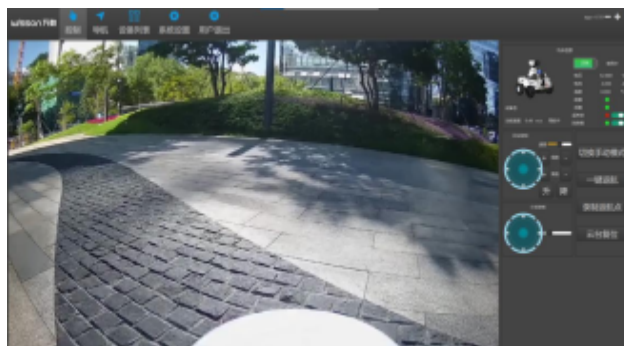
#### remote-control handle

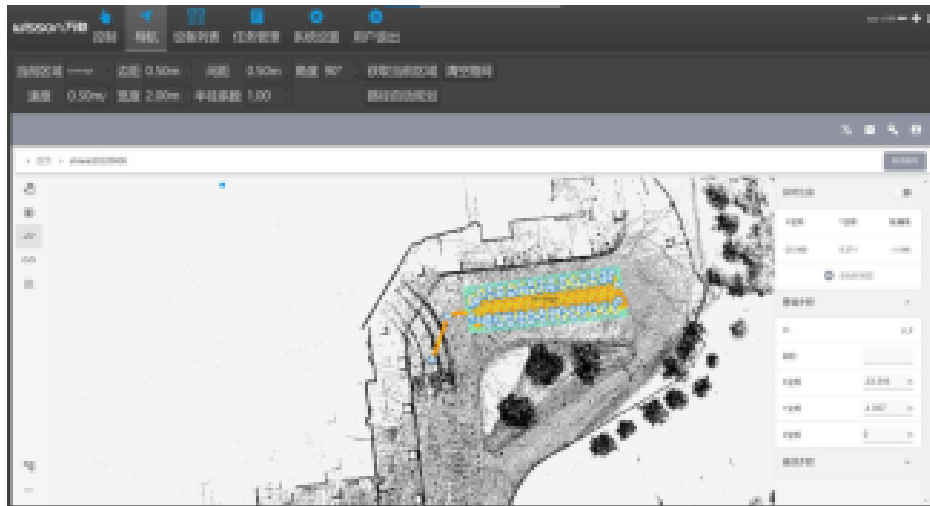
The remote control handle is used to control the movement of the robot, which can simply and conveniently realize the transportation of the robot and the artificial transfer of the robot.



Photo: Remote control handle

## Navigation





Self-group navigation function description:

#### **Drawing:**

- Multi-line Lidar 3D map construction of the scene;
- 3D drawing area of 250,000 square meters;
- Raster resolution of map construction is 5cm;
- The map construction function can be realized if the moving obstacle occupies less than 10% of the map area
- The map can be edited twice and virtual paths can be drawn
- 
- Forced closed-loop function based on global map information matching algorithm;
- Global initialization function

#### **Obstacle Avoidance**

- Stop when encountering obstacles or detour according to the path;
  - In the stop mode, you can set a safe distance to detect obstacles and keep stopping at a safe distance.
  - In the obstacle mode, it can identify stationary obstacles on the navigation path and re-select other feasible paths;

#### **Positioning**

- The average positioning accuracy is within 7cm, and the positioning accuracy of the task point is within 5cm;
- Maintain positioning accuracy under the condition that the environmental change is not more than 30%. 4.4 Navigation
- With fixed-point navigation, teaching waypoints, hand-drawn paths, track patterns, and other path planning methods;
  - In the fixed-point navigation mode, the optimal path can be generated independently, and the navigation accuracy to reach the target point is 5cm;
  - In the teaching path mode, it can run along the teaching path, optimize the path independently, and smooth the path;
- Maximum navigation speed 5km/h;