Converging Ecosystem

Agile Development

Navis

Industry-Level robot navigation solution

行业级移动机器人导航应用解决方案

Internal Reading Vision

内部审阅版本

Information Classification: Confidential

信息分类：内部公开

2022.05 Version 1.0 Shenzhen Links Enterprise

Navis Navigation

Industry-Level robot navigation solution

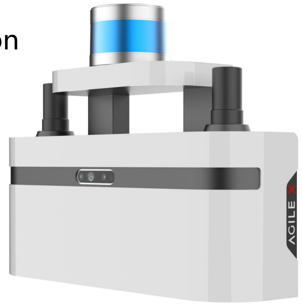
行业级移动机器人导航方案

NAVIS is an Industry-Level mobile robot navigation product designed for semi-closed and fully enclosed scenarios. It uses multi-line LiDAR/solid-state LiDAR, depth cameras, and IMU as the main sensors for environmental perception and scene construction. Combined with NAVIS Brain (navigation brain), NAVIS Bridge (data bridge), and multi-platform intelligent interaction NAVIS Board system, it achieves data visualization, scene map construction and management, task system management, and system management functions.

NAVIS navigation is compatible with the entire series of Agilex Robotics chassis, adopting a fully spliced perception solution. The mobile platform integrates perception hardware devices, achieving fully autonomous open top space. Camera+Lidar provides comprehensive positioning and safety protection, enabling the device to operate autonomously and safely. With multi-sensor fusion and true 3D perception, it achieves outstanding and reliable positioning capabilities.**Users do not need to have a background in mobile robotics knowledge. The product is ready to use out of the box, with continuous iteration and free upgrades, low cost, and support for rapid mass production.**

Product Features

- Environmental perception and scene construction
- Repeat positioning accuracy: ±5cm, travel positioning accuracy: ±10cm
- Secondary positioning point assisted positioning: supported
- Supports path points and path navigation
- Supports autonomous stop/obstacle avoidance, blind spot avoidance
- Data visualization
- Automatic charging



*The sensor bracket solution is for reference only and is not the only designated delivery form. Users can customize the design of dedicated sensor brackets according to the adopted vehicle model. Agilex Robotics provides customized sensor bracket services.

Hardware Configuration Plan

Industry-Level robot navigation solution

行业级移动机器人导航方案

360 version

Multi-line LiDAR	1PCS
9-axis attitude sensor	1PCS
x86 industrial computer	1PCS

Optional hardware:

Blind spot compensation camera	To be determined based on the adopted chassis type
RTK GPS	1PCS
4G router	1PCS
Gigabit switch	1PCS
Qianxun Network Service	1 year

Scene	Description	Note
Applicable	Indoor/Outdoor	Non-rainy, snowy, or foggy weather
Positioning	3D LiDAR positioning	Supports RTK-GPS assisted positioning
Maximum mapping area	200W ㎡	Closed-loop scene
Cross-floor	Not supported	
Repeat positioning accuracy	±8cm	
Maximum navigation speed	2.5 m/s	
Motion model	Supports Ackermann, differential, and four-wheel steering models	
Obstacle avoidance mode	Autonomous stop/obstacle avoidance	
Obstacle avoidance sensor	LiDAR, binocular depth camera	Ultrasonic sensors are not supported at present
Navigation mode	Autonomous navigation/path tracking	
Map import	Supports map import and migration between different devices with the same model, layout, and configuration	
Map export	Supports	
Map incremental expansion	Not supported	
3D point cloud map editing	Not supported	
2D point cloud map editing	Supports	
Communication method	Ethernet communication/WIFI communication	WIFI communication requires a WIFI router
Secondary development interface	Websocket/Http	Computing power is not open

Navis Navigation 360 Version Hardware Parameters

Industry-Level robot navigation solution

行业级移动机器人导航方案

Category	Detailed Parameters
Multi-line LiDAR	Laser wavelength：905nm Measurement range：150m(90m@10% NIST) Blind zone：≤0.2m Accuracy (typical value)：±2cm(1m to 100m) Horizontal field of view：360° Vertical field of view：30°（-15°~＋15°) Horizontal angular resolution：0.1°/0.2°/0.4° Vertical angular resolution：uniform 2° Output points：~288,000pts/s(single echo) ~576,000pts/s(dual echo) Product power (typical value)：11W Operating temperature：-40°C ~ +60°C Storage temperature：-40°C ~ +85°C Protection level：IP67
Industrial computer	CPU configuration：Intel i7 9th Memory: default 16G DDR4 (expandable to 32G)Hard disk storage space: default 512G SSD (industrial grade) Operating temperature：- 20~60°C（SSD) Storage temperature：- 40~80°C Relative humidity：10%~90%@40°C Vibratio：SSD：3Grms@5~500Hz，random，1 hr/axis Shock: 10G, 11-second interval, half-sine wave

Category	Detailed Parameters
IMU	Operating voltage：5~24V Supports 3-axis acceleration, 3-axis gyroscope, and 3-axis attitude angle data output Operating temperature：-20°C~85°C
Blind zone compensation camera (optional)	Operating distance：0.2m - 2.5m Color FOV ■ 16:9： H86° V55° D93.5°±3° ■ 4:3： H64° V55° Relative accuracy ■ 1.0%(center 81% area) @1000mm ■ 1.1%(center 81% area) @2000mm
RTK-GPS (optional)	Start-up time ■ GNSS cold start time< 25s ■ GNSS RTK initialization time<5s ■ Combined navigation alignment time<60s Supports Beidou, GPS, Galileo, and GLONASS satellite systems Heading accuracy ■ Dual antenna：0.1° ■ Single antenna：0.2° Horizontal positioning accuracy：1CM ± 1PPM

Navis Navigation

Hardware Configuration Plan

Industry-Level robot navigation solution

行业级移动机器人导航方案

Solid-state version

Solid-state LiDAR	3PCS
9-axis attitude sensor	1PCS
x86 industrial computer	1PCS

Optional hardware:

Blind zone compensation camera	To be determined based on the adopted chassis type
RTK GPS	1PCS
4G router	1PCS
Gigabit switch	1PCS
Qianxun Network Service	1 year

Scene	Description	Note
Applicable	Indoor/outdoor	Non-rainy, snowy, or foggy weather
Positioning	3D LiDAR positioning	Supports RTK-GPS assisted positioning
Maximum mapping area	200W ㎡	Closed-loop scene
Cross-floor	Not supported	
Repeat positioning accuracy	±8cm	
Maximum navigation speed	2.5 m/s	
Motion model	Supports Ackermann, differential, and four-wheel steering models	
Obstacle avoidance mode	Autonomous stop/obstacle avoidance	
Obstacle avoidance sensor	LiDAR, binocular depth camera	Ultrasonic sensors are not supported at present
Navigation mode	Autonomous navigation/path tracking	
Map import	Supports map import and migration between different devices with the same model, layout, and configuration	
Map export	Supports	
Map incremental expansion	Not supported	
3D point cloud map editing	Not supported	
2D point cloud map editing	Supports	
Communication method	Ethernet communication/WIFI communication	WIFI communication requires a WIFI router
Secondary development interface	Websocket/Http	Computing power is not open

Navis Navigation

Solid state version hardware parameters

Industry-Level robot navigation solution

行业级移动机器人导航方案

Category	Detailed Parameters
Multi-line LiDAR	Measuring Range (@ 100 klx) ■ 90 m @ 10% reflectivity ■ 130 m @ 20% reflectivity ■ 260 m @ 80% reflectivity Near blind spot：0.05 m FOV：70.4° circular Ranging random error：（1σ @ 20m) ■ 1σ (@ 20m) ≤ 2 cm [1] ■ 1σ (@ 0.2~1m) ≤ 3 cm [2] Angle random error（1σ）：< 0.1° Beam emission angle：0.28° (vertical) × 0.03° (horizontal) Operating environment temperature：-20℃ to 65℃ Protection level：IP67
Industrial computer	CPU configuration：Intel i7 9th Memory：default 16G DDR4（expandable to 32G） Hard disk storage space：default 512G SSD(industrial grade) Operating temperature：- 20~60°C（SSD） Storage temperature：- 40~80°C Relative humidity：10%~90%@40°C Vibration：SSD：3Grms@5~500Hz，random，1 hr/axis Shock：10G，11 second interval，half sine wave

Category	Detailed Parameters
IMU	Operating Voltage：5~24V Supports 3-axis acceleration, 3-axis gyroscope, and 3-axis attitude angle data output Operating Temperature：-20°C~85°C
Blind Spot Compensation Camera (optional)	Operating Distance：0.2m - 2.5m Color FOV ■ 16:9： H86° V55° D93.5°±3° ■ 4:3： H64° V55° Relative Accuracy ■ 1.0%(center 81% area) @1000mm ■ 1.1%(center 81% area) @2000mm
RTK-GPS（optional)	Start-up Time ■ GNSS Cold Start Time< 25s ■ GNSS RTK Initialization Time<5s ■ Combined Navigation Alignment Time<60s Supports Beidou, GPS, Galileo, and GLONASS satellite systems Heading Accuracy ■ Dual Antenna：0.1° ■ Single Antenna：0.2° Horizontal Positioning Accuracy：1CM ± 1PPM

Industry-Level robot navigation solution
行业级移动机器人导航方案

Considerations for Hardware Configuration

- The selection of routers will be adjusted based on customer needs and scenarios. For example, in a robot operating scenario where an AP hotspot is required, a vehicle-side router can be selected. The vehicle can connect to the designated AP hotspot using its own WiFi, and will be assigned an IP address. Customers can communicate with the vehicle by accessing this IP address. If customers have specific requirements for routers in their scenarios, they can choose their own routers and configure them with the corresponding IP and network segments.
- The blind spot optimization camera uses a depth camera, which may generate noise and affect its normal operation under strong outdoor sunlight. Since different vehicle models have different dimensions and positions, the blind spots will vary after installing the LiDAR. Therefore, it depends on the specific vehicle model.
- If automatic charging is required, the current automatic charging solution uses a vision-based approach, and an additional camera solution is needed for secondary alignment of the charging pile.
- Currently, the combined navigation is mainly used in relatively open outdoor areas to assist LiDAR in repositioning.
- If the combined navigation is chosen, it is necessary to evaluate whether the Qianxun service can be used in the area where the combined navigation is used.

Industry-Level robot navigation solution
行业级移动机器人导航方案

Additional Explanation on Technical Parameters.

- The mapping area is mainly affected by whether the scene is closed-loop and the impact of environmental data packets. It is also affected by the storage space of the industrial computer. In cases with larger space, autonomous path planning is affected by computing power. The larger the space size, the farther the distance between path points, and the higher the computing power required.
- Cross-floor mapping means that after completing mapping within a plane, you can directly build other vertical floors at different heights without re-recording the map. However, you can rebuild a second map format for map construction.
- The repeatability accuracy test environment has distinct structural features, and the scene change rate is less than 10%. If the scene change rate is too high, it may lead to lower repeatability accuracy.
- Map incremental expansion refers to expanding the map of unknown areas directly based on a partially built map, without the need to rescan the previously built map.
- Elevator control and IoT: Currently, the navigation map description does not directly support elevator control modules and IoT modules. We are evaluating possible options and suitable logic
- At present, the computing power of the navigation host does not support deploying client applications. If customers need to develop their own corresponding applications, additional computing units need to be configured.

Navis Navigation **Software Interaction Platform**

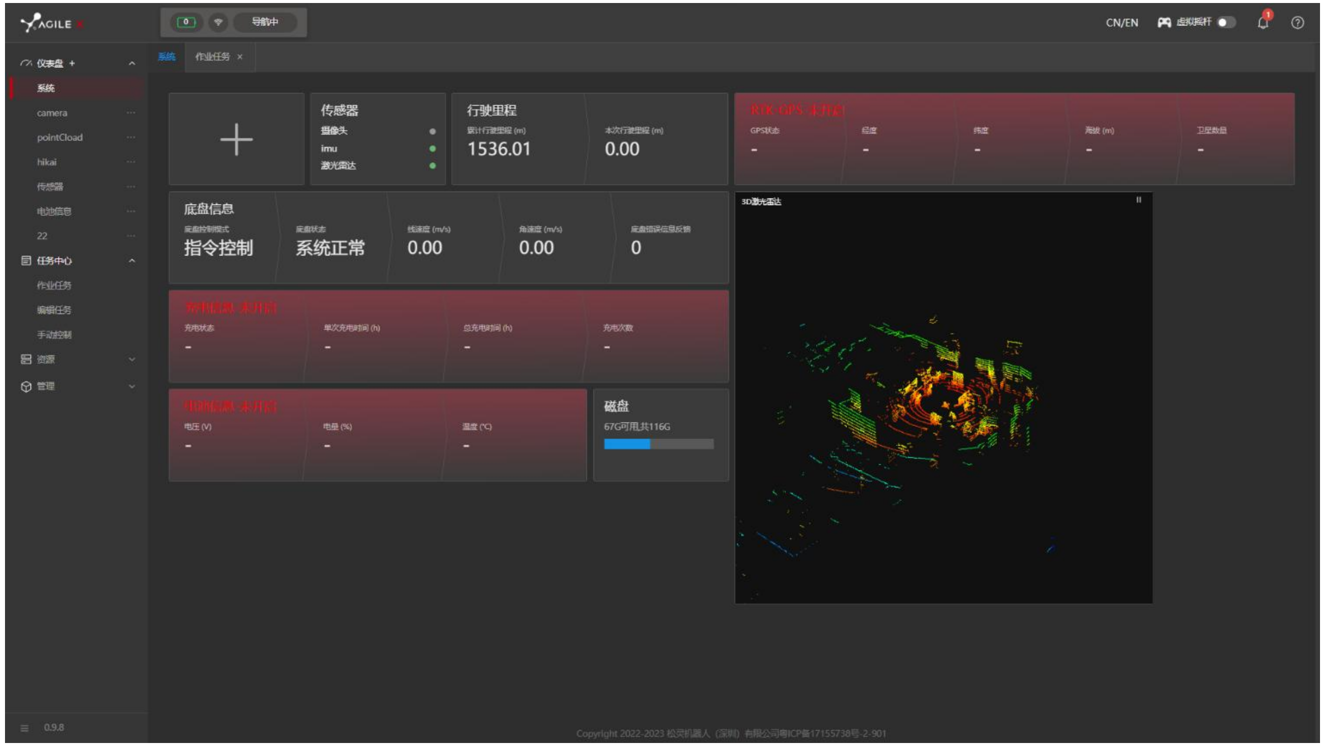
Industry-Level robot navigation solution

行业级移动机器人导航方案

Navis Board software interaction platform is a web-based, full-platform robot management system software that can be customized for different industries. Its main basic functions include:

- Data visualization, including but not limited to:
  - Travel mileage data
  - Vehicle status data
  - Battery data
  - LiDAR data
  - Storage space data

- Map management: map creation, map editing
- Task management: task planning, task management, task execution
- System management and third-party ecological application access

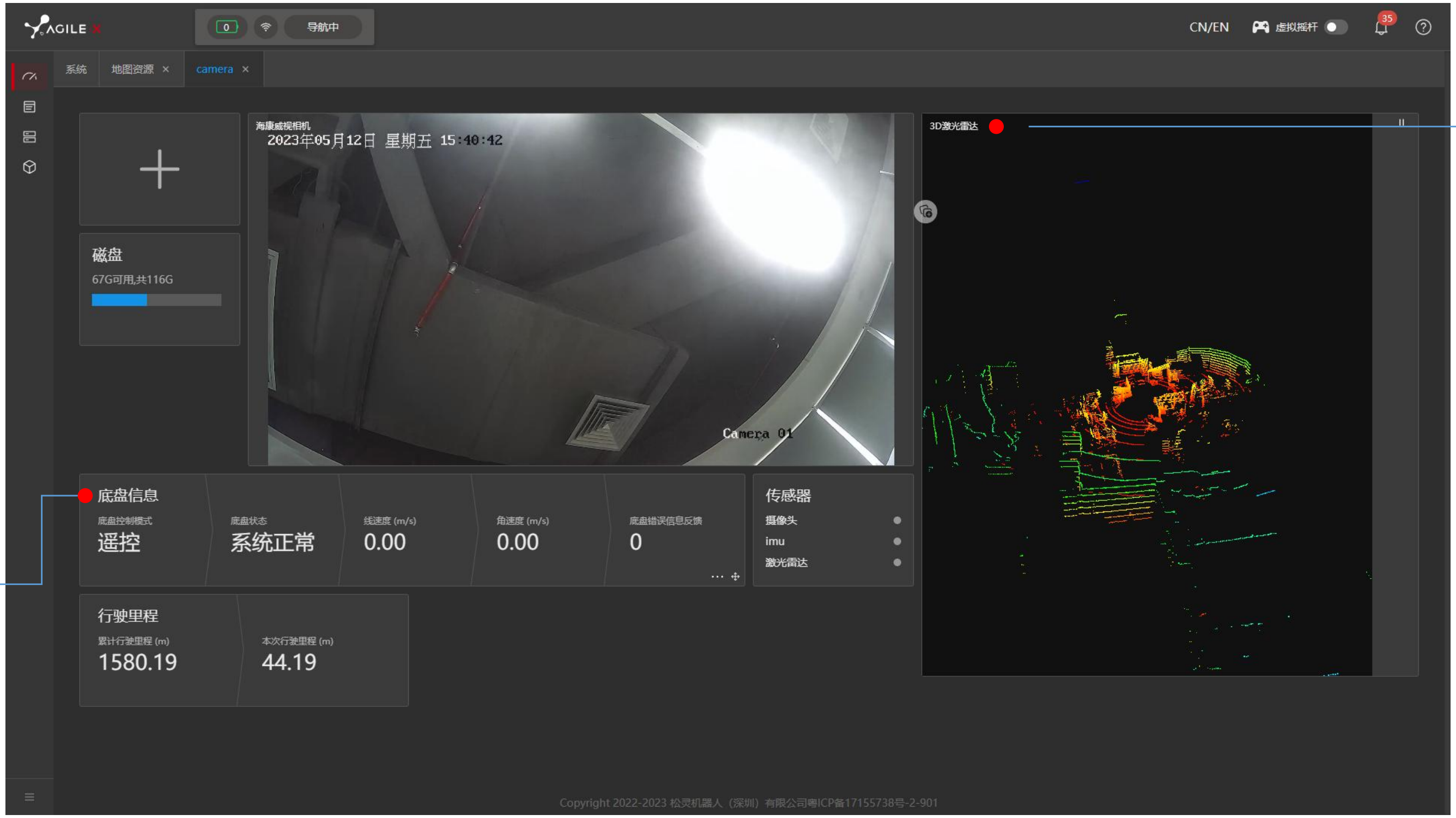


Navis Navigation **Software Interaction Platform**

Industry-Level robot navigation solution

行业级移动机器人导航方案

The data dashboard is a specific presentation module for data visualization. Users can freely add the required data types to the dashboard. Users only need to drag and drop the required data blocks to the dashboard, and they can subscribe to the corresponding real-time data types on the dashboard.

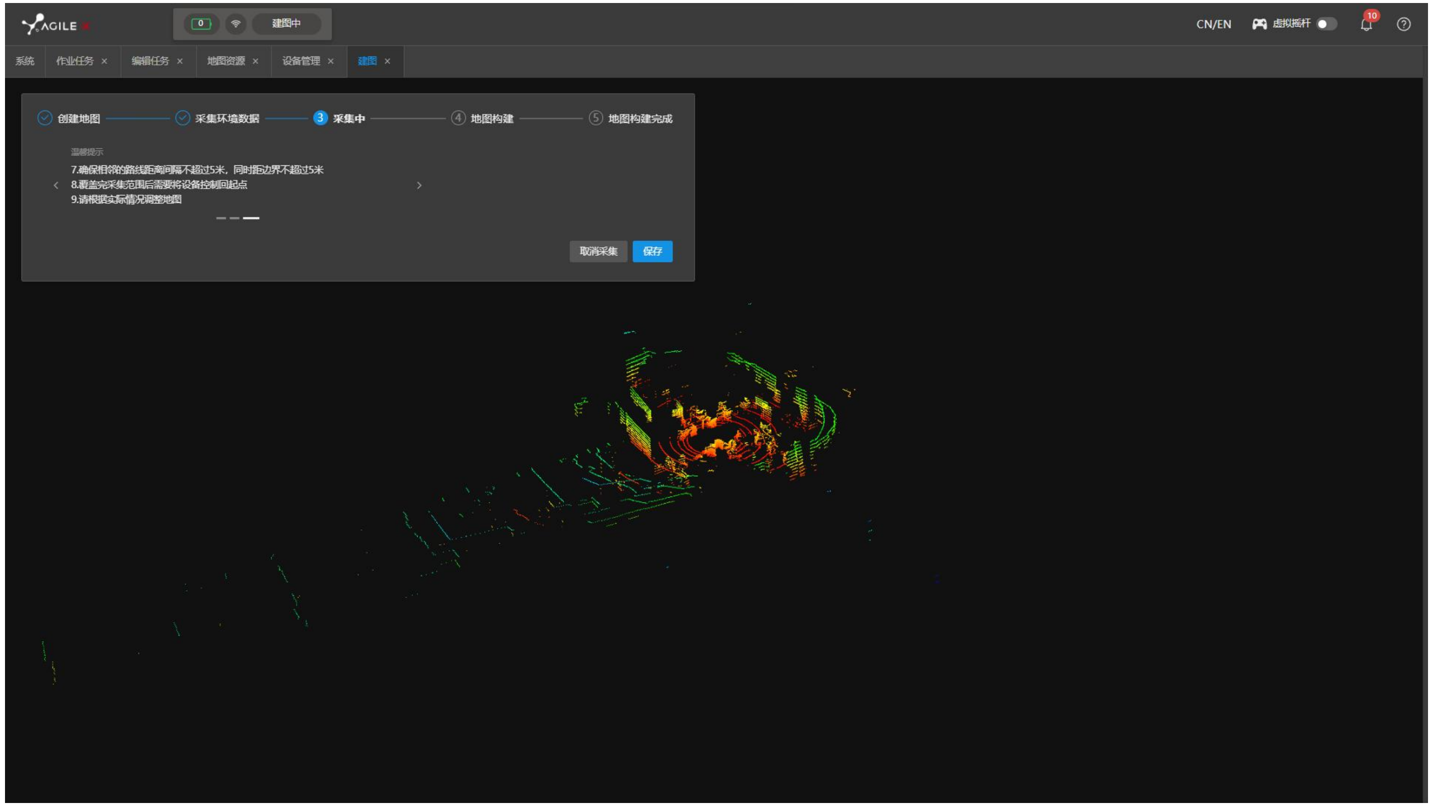


Users can add data dashboard types based on their own business needs, and can also customize the presentation of their own enterprise data dashboard (including logo customization). This part is supported by Agilex Robotics' customized service team.

Navis Navigation Software Interaction Platform

Industry-Level robot navigation solution

行业级移动机器人导航方案

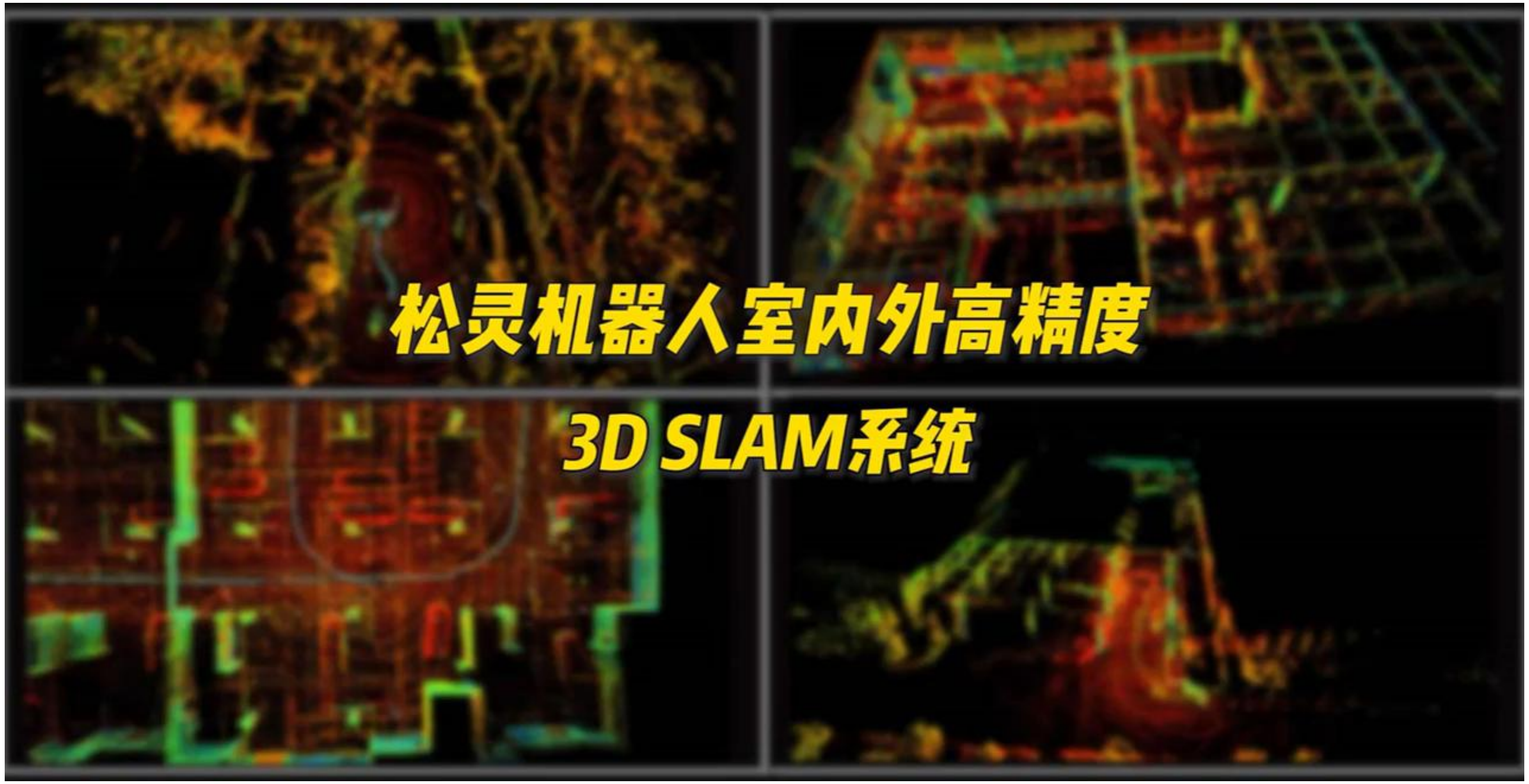


Navis Board has a complete navigation and mapping guide. When users enter the navigation map construction task, they only need to follow the task guide to quickly complete the navigation map construction, which will be automatically saved in the map resources for easy modification and retrieval at any time.

Navis Navigation **Software Interaction Platform**

Industry-Level robot navigation solution

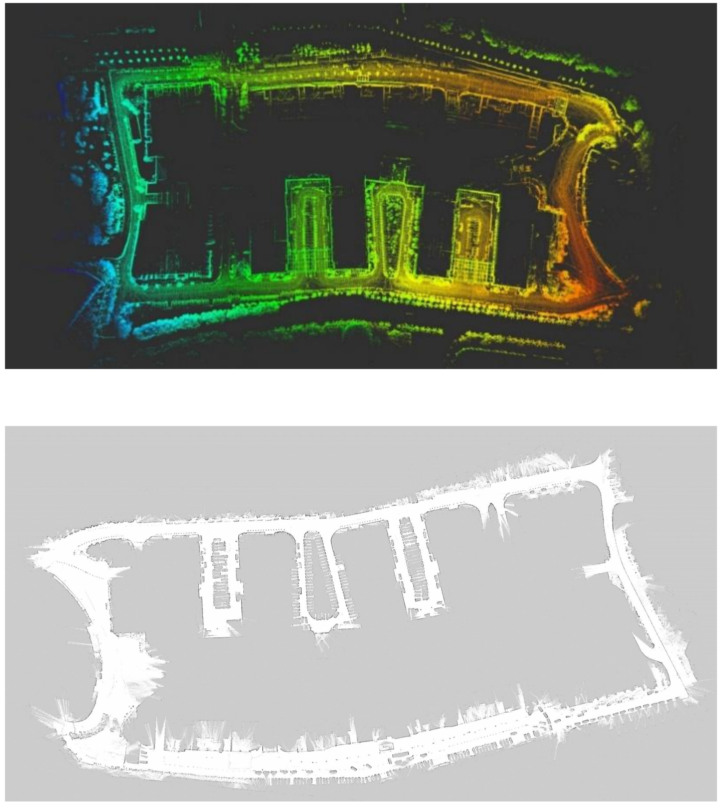
行业级移动机器人导航方案



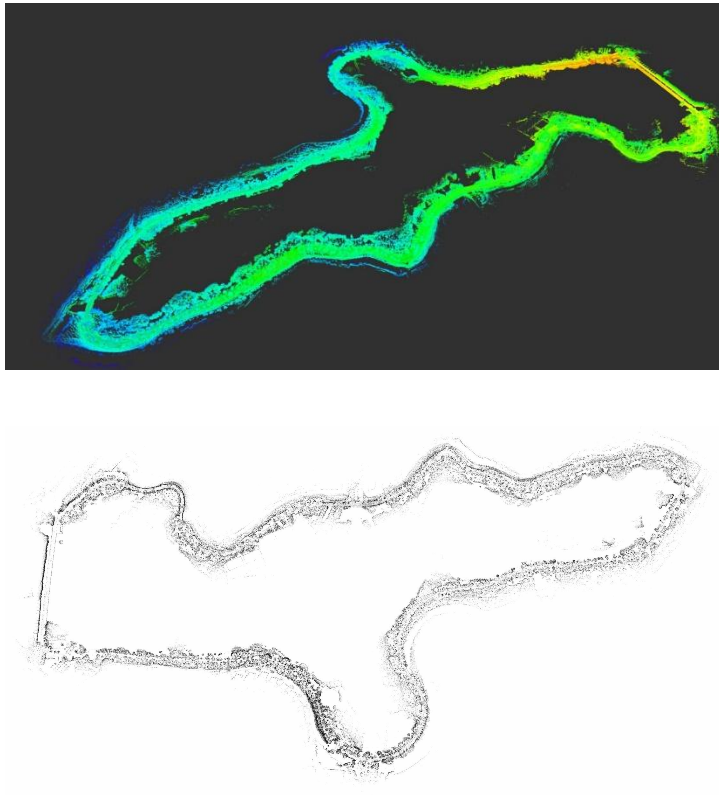
Navis Navigation Software Interaction Platform

Industry-Level robot navigation solution

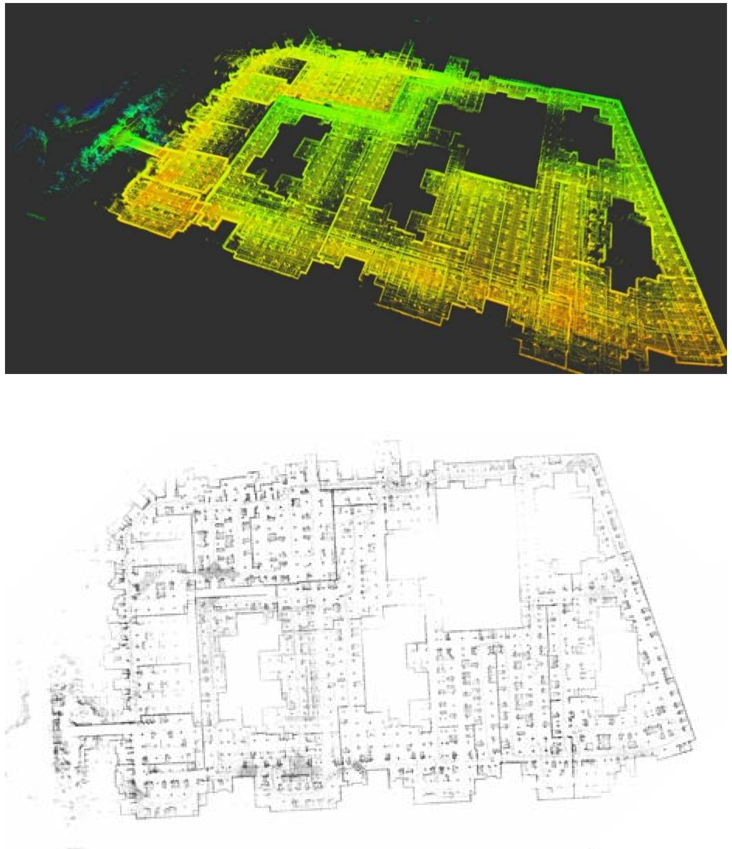
行业级移动机器人导航方案



Mapping effect of semi-closed community with an area of 30W㎡



Mapping effect of outdoor park with an area of 115W㎡

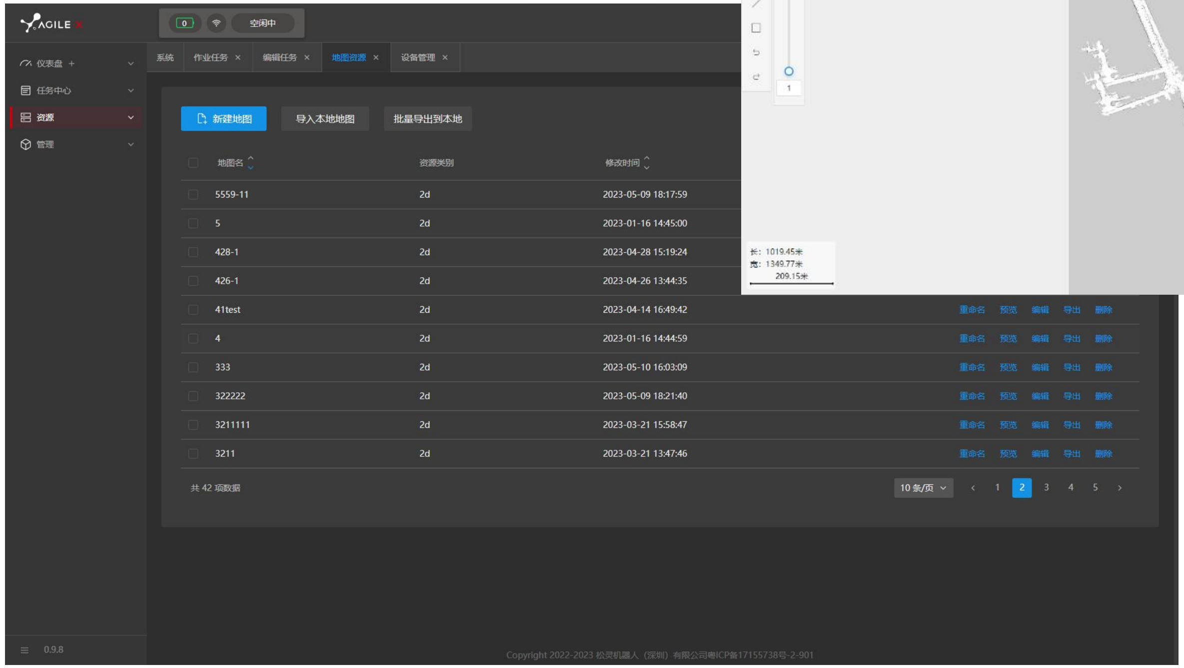


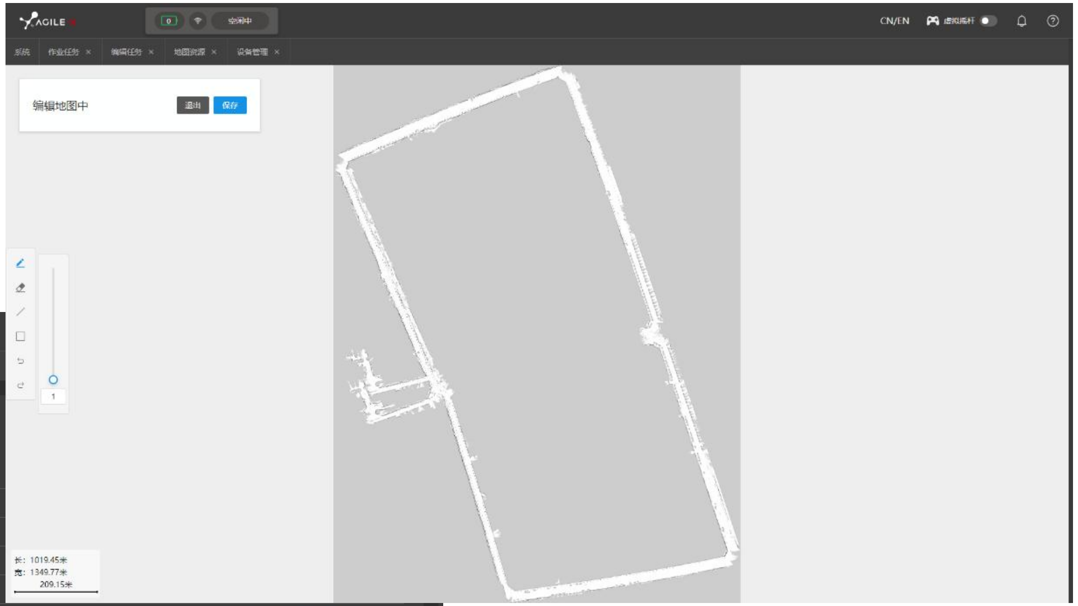
Mapping effect of underground parking lot with an area of 16W㎡

Industry-Level robot navigation solution

行业级移动机器人导航方案

The Navis Board resource section contains all the navigation map data created by the user's history. Users can easily name, preview, edit, export, and delete maps, and can switch between point cloud maps of different work scenarios at any time.



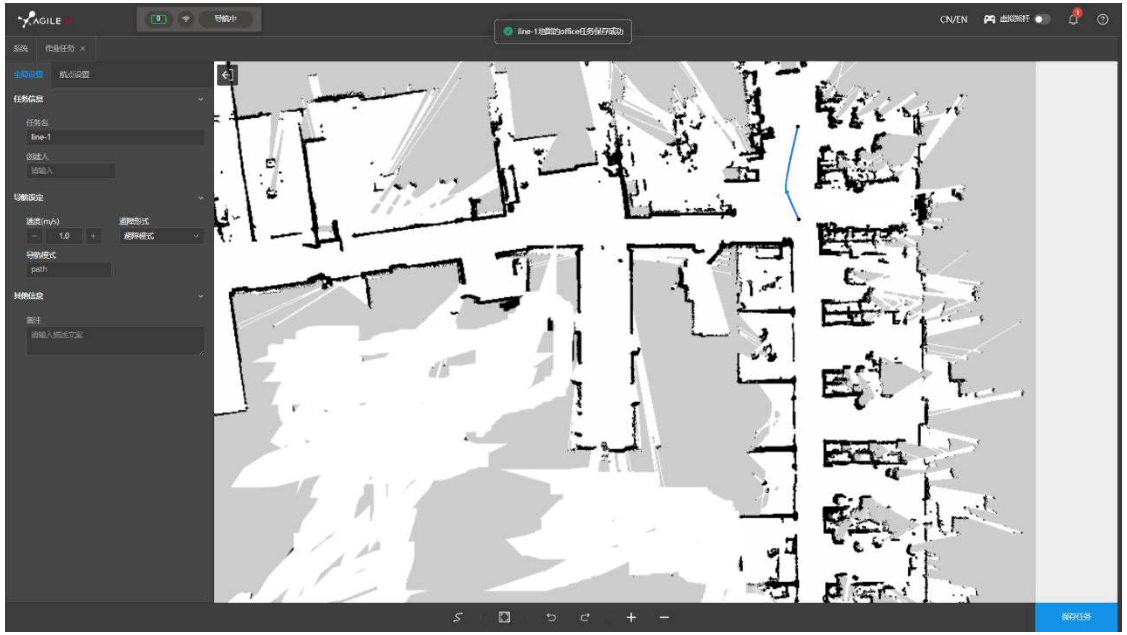


In the map editing module, users can edit the already constructed map resources. They can erase map obstacle areas and set virtual walls (enclosing the robot's operating area) to make the map boundaries clearer and facilitate the robot's smoother operation in the working environment.

Navis Navigation Software Interaction Platform

Industry-Level robot navigation solution

行业级移动机器人导航方案



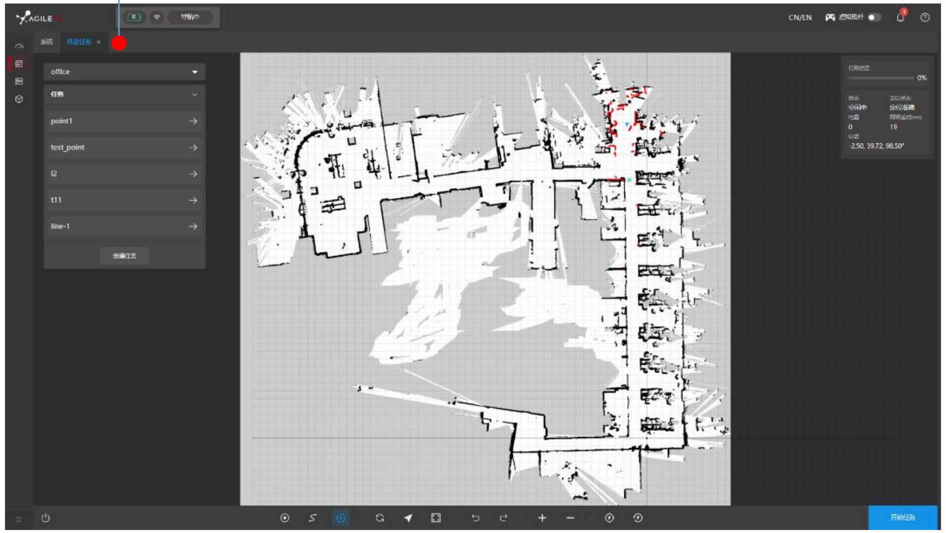
In the task management module, users can choose point navigation mode. In this mode, users can select robot navigation waypoints in the already constructed point cloud map and set specific task actions for the robot when it reaches the navigation waypoint, such as orientation, etc.

Users can also choose path navigation mode. In this mode, users can set the complete robot walking path and the robot's traveling speed and obstacle avoidance mode. It also supports setting specific task actions for the robot when it reaches the end of the path, such as orientation, etc.

Industry-Level robot navigation solution

行业级移动机器人导航方案

After establishing the corresponding navigation task in the task management module, users can select the corresponding navigation task for the robot's autonomous navigation operation. After selecting the task, click the "Start Task" button in the lower right corner. During the task, the task can be paused or resumed at any time.

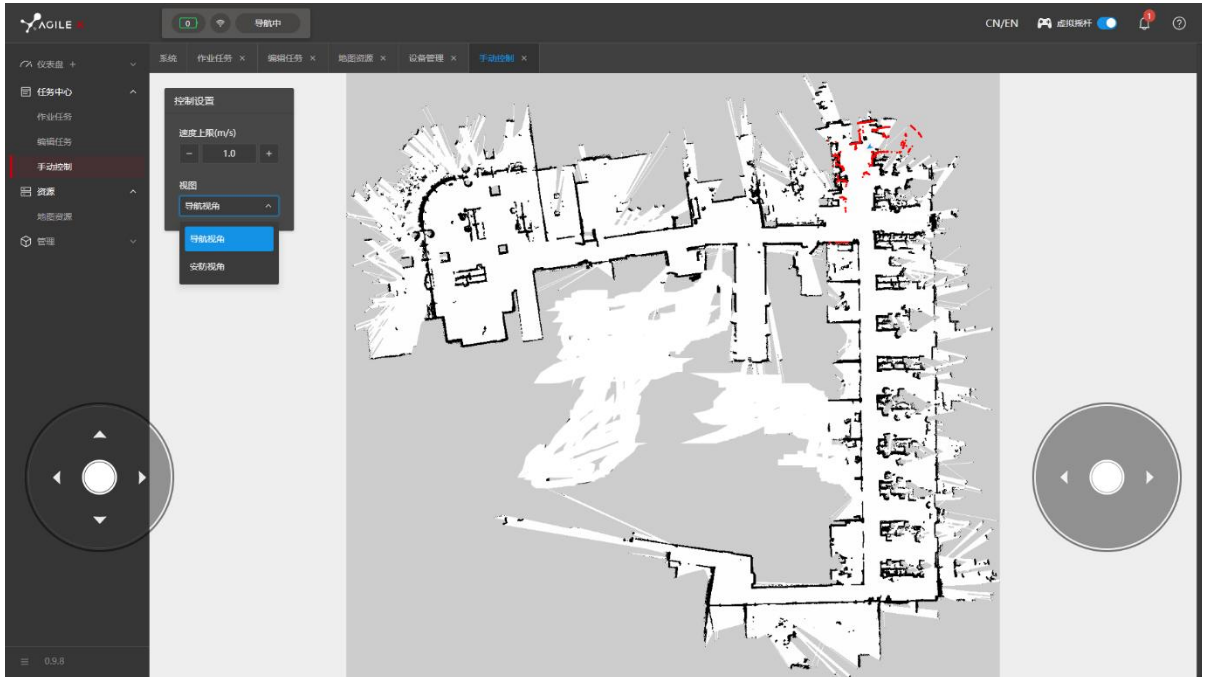


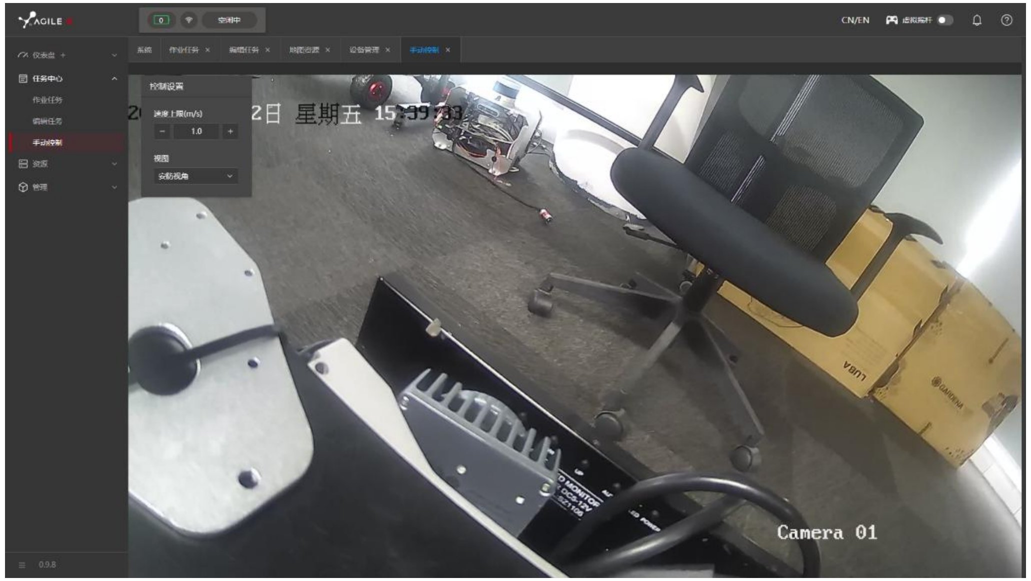
During the execution of the navigation task, users can view real-time feedback on the current task progress, status, positioning status, battery level, network delay, and pose information through the dashboard at any time.

Navis Navigation **Software Interaction Platform**

Industry-Level robot navigation solution

行业级移动机器人导航方案



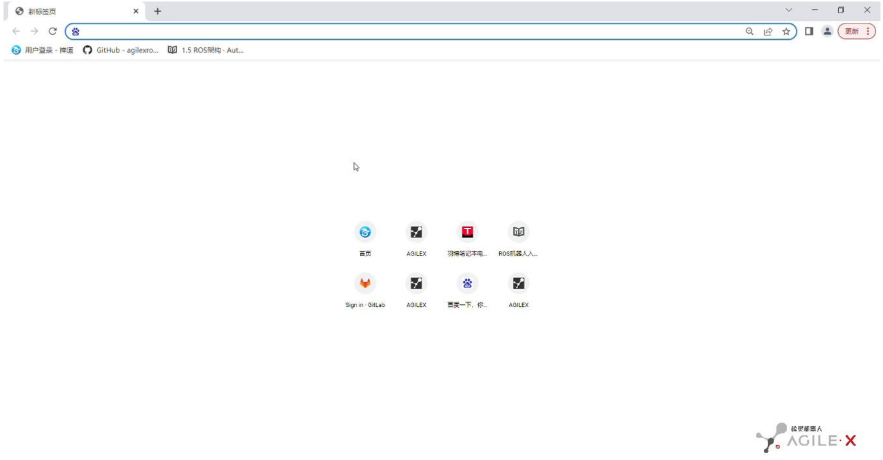


Users can choose to manually control the robot's movement (under local area network or 4/5G network conditions). In this mode, the software backend will have a virtual joystick, and users can choose between security or navigation perspectives to remotely control the robot's movement and operation.

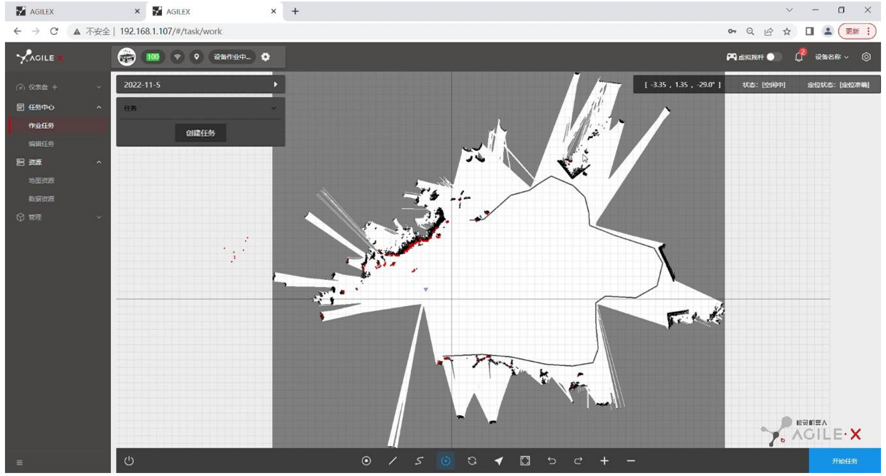
In the security perspective, there is a high-definition remote image transmission. Through server transparent transmission, the scene image can be presented in real-time, and users can control the movement of the mobile robot based on the image transmission.

Industry-Level robot navigation solution

行业级移动机器人导航方案



Map Building and Map Editing

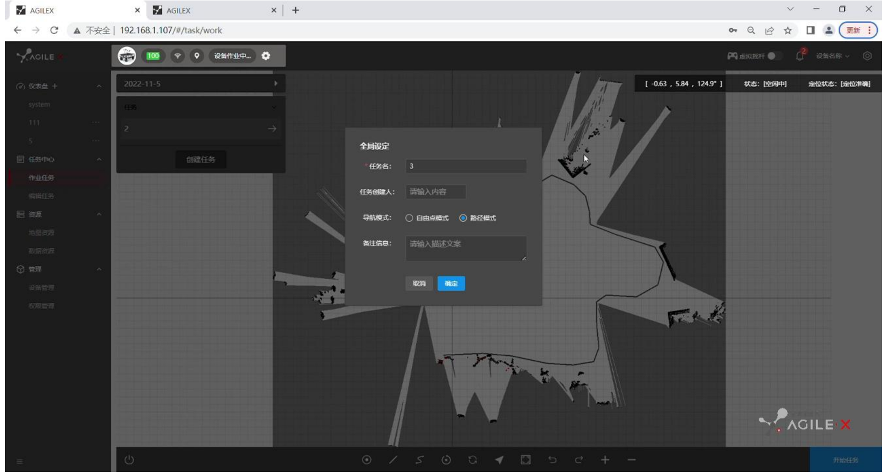


Task Points and Execution

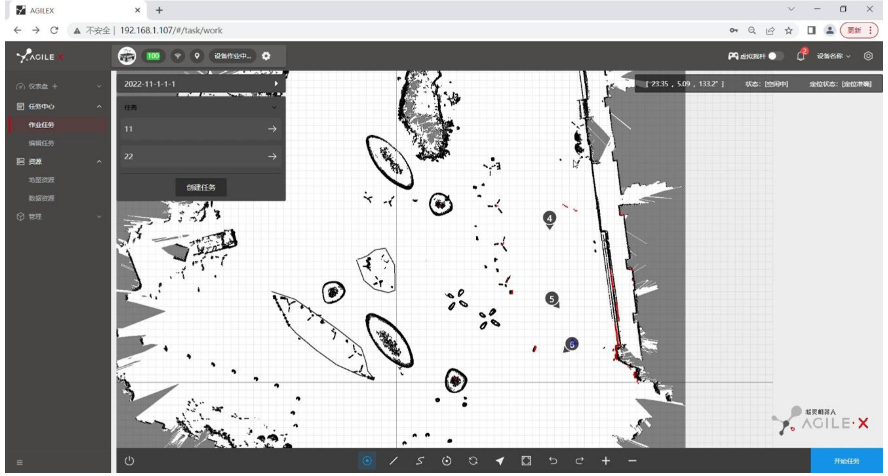
Navis Navigation **Software Interaction Platform**

Industry-Level robot navigation solution

行业级移动机器人导航方案



Line Segment Task and Execution



Navigation Task and Execution

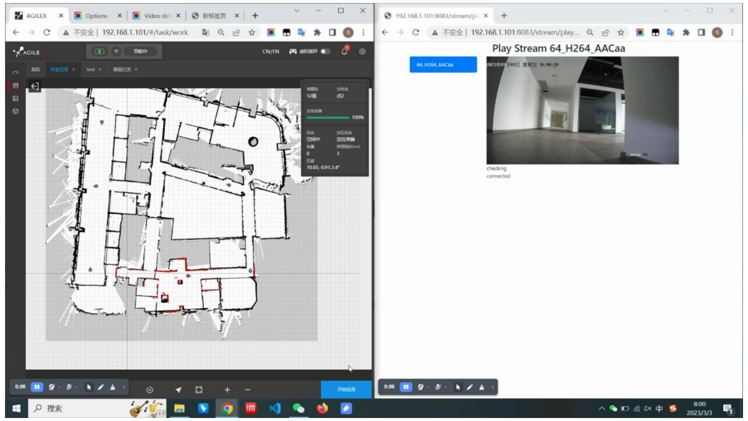
Navis Navigation

Software Interaction Platform

Industry-Level robot navigation solution

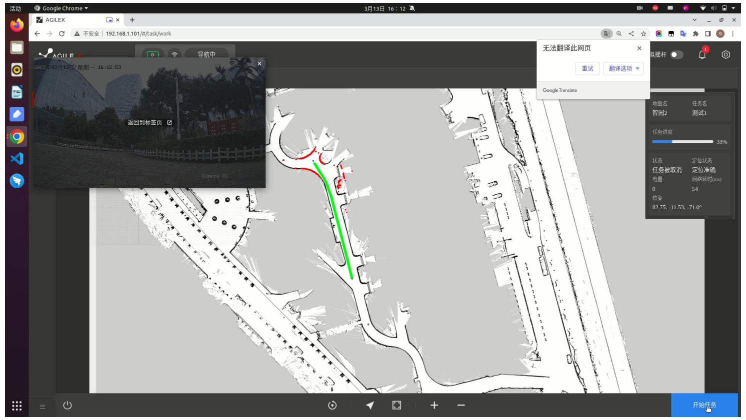
行业级移动机器人导航方案

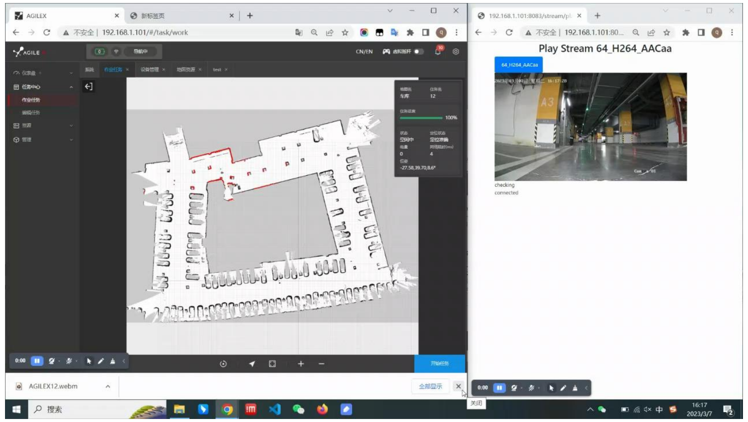
Large Closed Factory Area



Interior of Commercial Buildings

High-tech Industrial Park



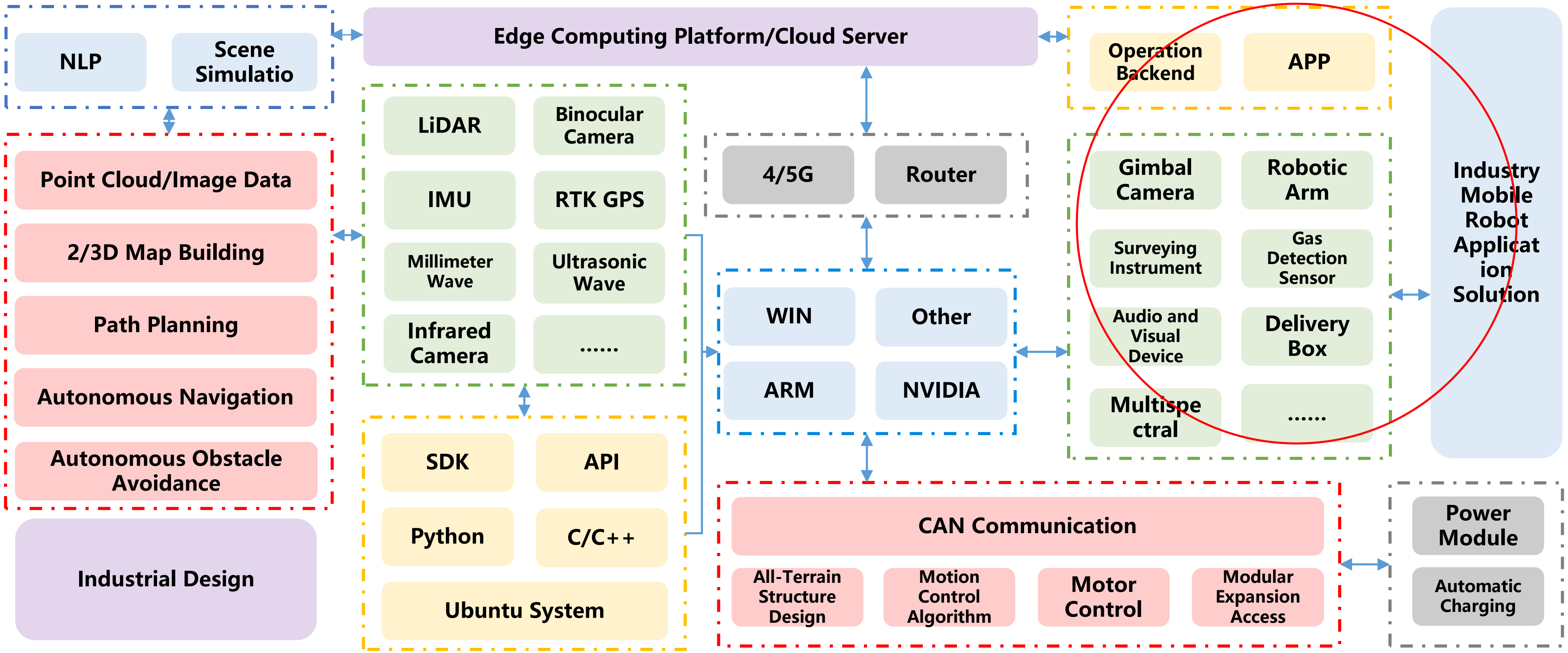


Underground Parking Lot

Navis Navigation **Software Interaction Platform**

Industry-Level robot navigation solution

行业级移动机器人导航方案

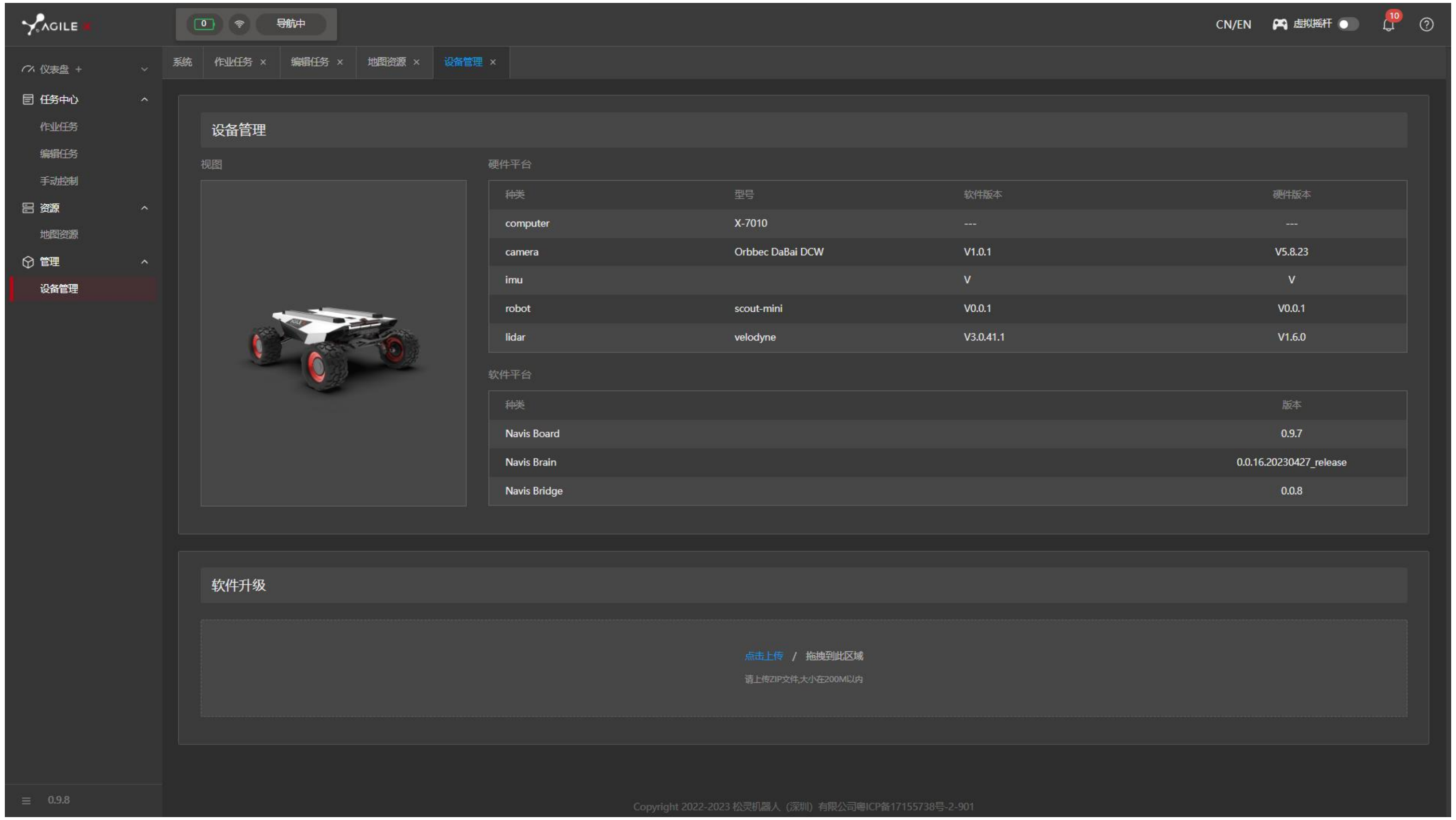


The Navis Board software platform enables agile and efficient development of mobile robots. Regardless of the industry application, it can be quickly integrated based on Navis Board. For example, in security inspections, users need to add a gimbal dual-camera. Based on the Agilex Robotics mobile chassis, it can be quickly deployed on hardware, and only needs to add the corresponding interface on the software to complete the deployment of the gimbal dual-camera quickly. It supports the rapid integration of many third-party applications.

Navis Navigation **Software Interaction Platform**

Industry-Level robot navigation solution

行业级移动机器人导航方案



The Navis Board software platform management module is a third-party application management module. This module supports customized development and can easily and quickly manage the connected devices, such as gimbal cameras, robotic arms, omnidirectional instruments, etc. Users can entrust Agilex Robotics to customize development and quickly form mobile robot industry application solutions.

Navis Board provides a unified and fast application integration mode. In this mode, users do not need to care about the underlying implementation, what you see is what you get, and there is no need to worry about software adaptation. It only needs to be integrated as a plugin or selected in the plugin store to easily incorporate the corresponding device into the unified system platform.

AGILE·X Robotics

Industry-Level robot navigation solution

行业级移动机器人导航方案


书签

AgileX NAVIS 导航模块API-V0.0.1.0
关于文档
产品核心优势
使用说明
发布说明
注意事项
HTTP API
登录接口
登录请求
地图相关接口
获取地图列表
获取某个地图信息
下载某个地图图片
上传某个地图图片
重命名某个地图
删除地图文件
导出某个地图包
导入某个地图包
批量导出地图包
任务相关接口
版本信息
获取软件版本信息

地图相关接口

获取地图列表

- **GET请求:**
  http://localhost:8880/map_list?page=1&limit=5&sortType=&reverse=
- **请求头部:**
  Authorization:从/login接口返回的数据中获取值
- **接口说明:**
  获取地图列表，返回根据请求参数查询到的地图列表数据
- **请求参数:**
  表单数据
  - `page`:页数从(第一页开始)
  - `limit`:一页显示的条数(数值为-1时，获取全部列表数据)
  - `sortType`:排序的类型,可填入的值`name`:按照名称排序，`time`:按照时间排序，`null`:不排序
  - `reverse`:是否倒序,可填入的值`true`:倒序，`false`:正序
- **应答数据:**

Comprehensive technical support

- ✓ Comprehensive API technical documentation and sample engineering code will help accelerate your deployment.
- ✓ The engineer's after-sales technical support communication group will directly solve the technical problems you encounter during the technical development process.
- ✓ For subsequent engineering optimizations, we will provide software upgrade packages to upgrade your products.
- ✓ For customized requirements, we will also conduct appropriate and reasonable evaluations to provide satisfactory services.

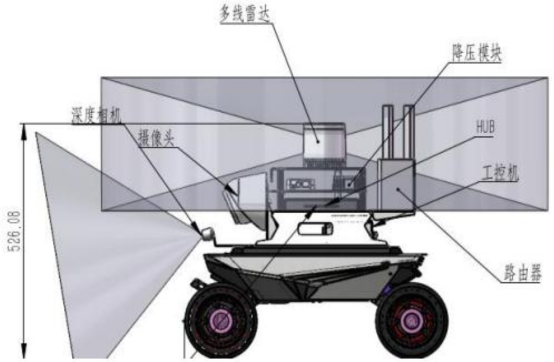
If the navigation system comes with a wireless router (optional), through the design of Navis Bridge, users can directly connect to the system via a local area network or Ethernet, and perform secondary development through WebSocket and Http protocols. The interface includes sensor raw data, map building, map editing, task editing, task management, system status, etc. Agilex Robotics will also provide rich sample code to guide users on how to use and develop our products.

Industry-Level robot navigation solution

行业级移动机器人导航方案

Project Requirements

The customer wants to conduct comprehensive testing of outdoor cluster scheduling and control algorithms based on multiple devices. They need to find devices with the ability to locate and navigate in relatively open outdoor areas and transmit video. The small car is required to have positioning and navigation capabilities, autonomous obstacle avoidance capabilities, and a portable mobile chassis. The multi-mode small car should have the ability to self-organize a network, making it easy to centrally schedule and control multiple devices. The customer also requires the ability to access some raw sensor data interfaces.



Solution Description

By using the SCOUT MINI small four-wheel differential mobile chassis with NAVIS 360 version, and one Hikvision security camera, communication is achieved through a small wireless router with mesh self-organizing network, which has realized convenient testing. The customer quickly completed the scheduling algorithm development and verification experiment of multiple devices through http and websocket interfaces, accelerating the progress of research and development and experiments.

Solution Configuration

SCOUT MINI Off-road version + Hikvision security camera + H3C Mesh router + NAVIS 360 version + customized bracket service.

Thank You

松灵机器人（东莞）有限公司

AGILEX ROBOTICS (DONGGUAN) CO., LTD.