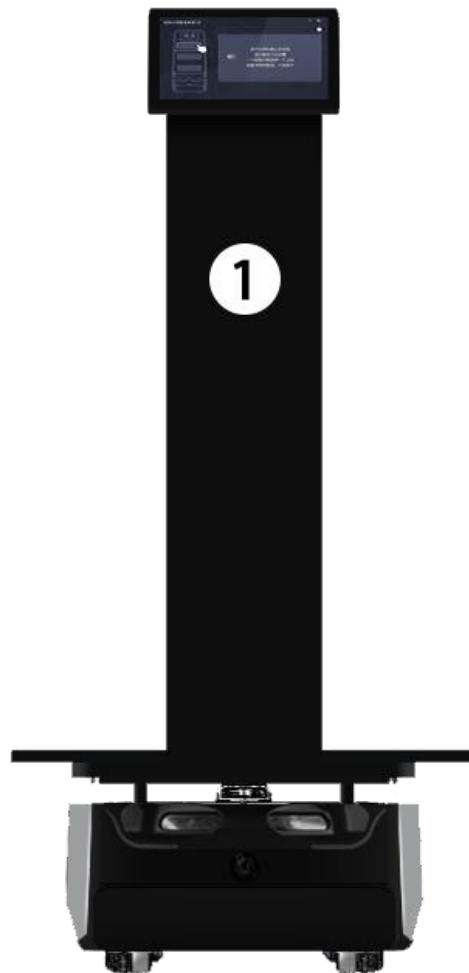


Intelligent Factory Delivery Robot

P3 Pro

User Manual



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1. Background

This document is a quick manual for the Intelligent Factory Delivery Robot when it enters the site. Operators can refer to this manual in conjunction with the site environment to improve the efficiency of deployment.

Note: Before the site deployment, the customer should carry out the site environment survey work to understand the site environment, if necessary, need to carry out the preliminary environmental transformation.

2. Mapping

2.1 Environmental preparation

1. Try to sweep at a point in time when the area to be swept is empty, or less crowded.
2. Try to remove frequently moving objects from the area to be swept.
3. For reflective, translucent and light-absorbing objects in the scene, try to stick other materials that do not affect the normal scanning of the lidar at the lidar scanning plane of the robot if the conditions is allowed.

2.1.1 Navigating POI points

Note:

- 1) If there is an obstacle near the POI, it must be greater than 40cm.
- 2) When building POI points, try to move the robot directly to the specified location and create POI points at the current location, so that the POI points station created are highly accurate.

2.1.2 Location of charging station

The location of the charging station has a significant impact on the success of the machine's automatic return to the charging station , so a suitable location needs to be selected according to the following requirements.

Charging station location selection considerations:

- 1) Obstacles on the left and right sides need to be larger than 35cm.

- 2) The charging station needs to be against a wall, not placed in an area such as a mirrored wall or a hollowed out back.
- 3) The charging station location should not be placed on a soft floor such as carpet, otherwise it will create a height difference and will not be able to be charged
- 4) The location of the charging station in the scene needs to be marked to prevent incorrect recovery after moving.

Obstacles include: magnetic strips for obstacle avoidance, virtual forbidden area, and physical obstacles.

For the location of fall prevention, it is recommended to draw the forbidden zone and virtual wall directly to prevent the robot from accidents.

2.2 Software requirements

- App Build map

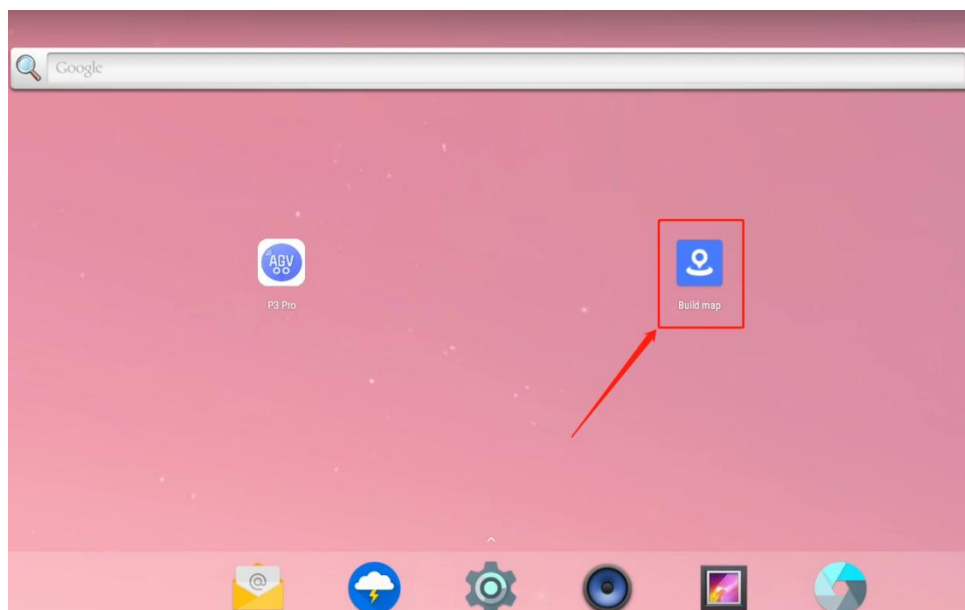


Figure 2-1 Buildmap map building tool

- Robostudio with full functionality
- Robostudio tool download link: <https://www.slamtec.ai/home/support/>
- You can also contact SLAMTEC's operation and maintenance staff to get the offline installation package.

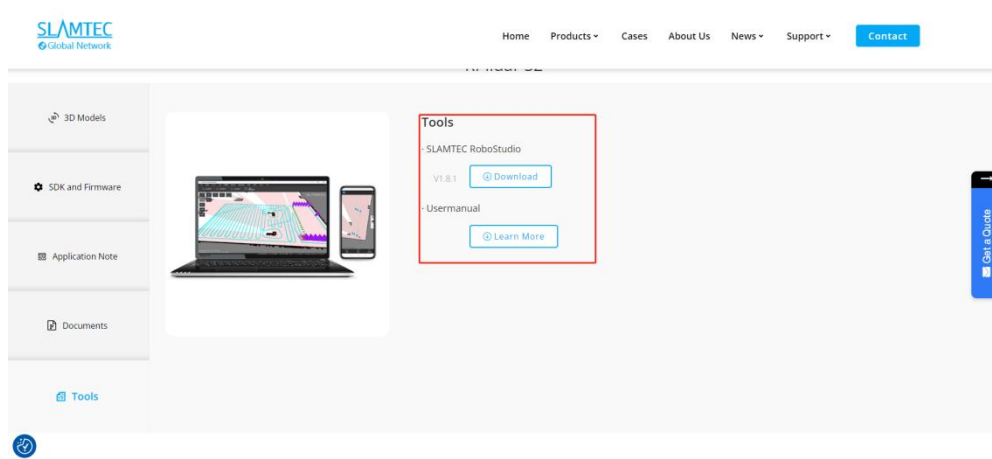


Figure 2-2 RoboStudio map editing tool

2.3 Creating maps

2.3.1 Opening the Build map App

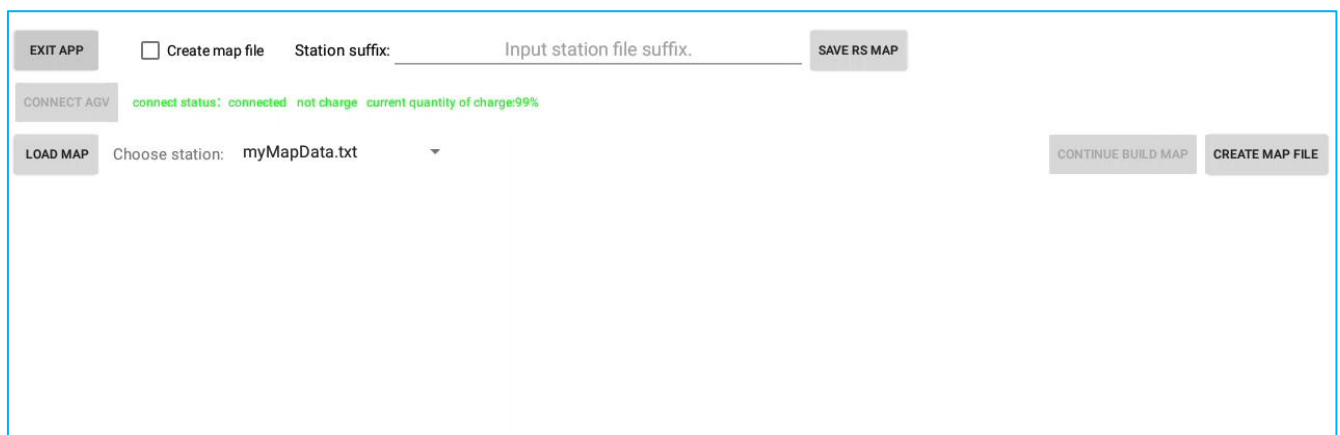


Figure 2-3 Build map tool

1) EXIT APP

Exit the Build map App.

2) Create map file

Create a map, if you open the app with the intention of doing map building work, make sure to check this option.

3) CONNECT AGV

If the robot information is not displayed for a long time after opening the build map, you can click "CONNECT AGV" to reconnect.

4) LOAD MAP

Load map, after clicking "LOAD MAP", the existing map will be loaded and the corresponding point group data of "Choose station" will be displayed.

5) Choose station

Multi-group station option. If there are several groups of points under the same map, you can choose to operate a certain group of points here, the default is myMapData.txt.

6) CREATE MAP FILE

When creating a new map and clicking "CREATE MAP FILE", please make sure the robot is on the charging station.

7) START MAP SCAN

Turn on the map refresh, the robot will start scanning to create a map, at this time the robot will synchronize the creation of charging piles, so please ensure that the robot is on the charging piles, and will be displayed in Figure 2-4, at this time you can press the brake button and move the robot to start scanning the environment to build a map, in the process of movement, the radar installed on the robot body will be scanned for the environment, at the same time, the robot will process the radar data and generate a map. Figure 2-4.

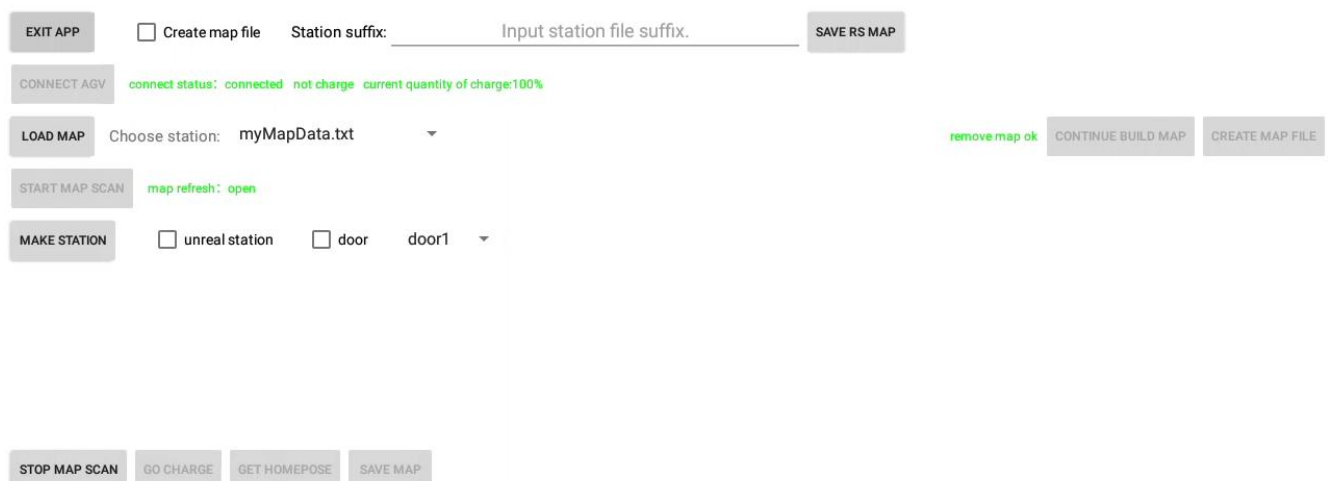


Figure 2-4 Open map refresh

The following principles should be followed when controlling the robot traveling to build a map:

- Lower speeds are recommended, less than 0.5m/s, depending on the current platform capabilities.
- Take more loops that produce closed loops.
- After the loop returns to the origin, keep the robot moving and take more overlapping paths. Do not stop moving immediately.
- After the loop returns to the origin, if the map does not close, continue walking until it does.

In the process of scanning the map, please try not to let the robot walk in a serpentine line, do not go backwards, the first time you can quickly walk around to let the map closed!

8) MAKE STATION

Set POI points. Marking specific points, including position and rotation angle, can facilitate subsequent reuse. It is recommended to move the robot to each point after scanning the environment first, and then click "MAKE STATION" to set POI points.

a.**unreal station:** virtual point. If you don't work according to the route of the robot's automatic navigation, you need to let the robot follow a fixed route to perform the task, check this option, you can set up several virtual points on the fixed route between the robot and the target Poi points, the robot will run along the virtual point.

b.**door:** motorized door points. This function is used when passing through a motorized door. Since using this function requires customization; the manual does not explain it in detail.

9) STOP MAP SCAN

Turn off map refresh and stop scanning. When the robot has finished scanning and creating maps and POI points, you can click "STOP MAP SCAN".

10) **GO CHARGE**

After turning off the map refresh, click "GO CHARGE" to let the robot return to the change station by itself, please make sure the brake button is released before clicking this button.

11) **GET HOMEPOSE**

Get the coordinates of the charging station. After clicking "GO CHARGE" and the robot returns to the charging station, click "GET HOMEPOSE" to get the coordinates of the charging station.

12) **SAVE MAP**

To save the map, click "GET HOMEPOSE", and then click "SAVE MAP" to save the map after getting the home pose successfully.

13) **SAVE RS MAP**

After editing the map through RoboStudio and upload to the firmware, open Buildmap and click "SAVE RS MAP" to save the edited map.

3. Edit map process

In the actual distribution environment, in addition to the map environment in which the robot walks, some special areas need to be marked and selected, which can be edited through RoboStudio and Robot connected.

3.1 Connecting Robots

The robot and outside systems can be connected via the network. However, for the safety of the robot, the hotspot is turned off by default. Before using RoboStudio to connect to the robot, you need to turn on the hotspot according to the following steps.

there are two ways to connect RoboStudio to the machine.

Way 1: Make sure your computer is connected to the robot's AP hotspot (AndroidAP by default), enter the

Robostudio software, click "File" -> "Robots", in the Robots panel, right click and select "Manual Connect Robot". In the Robot panel, right click and select "Manual Connect Robot", enter the IP address (default is 192.168.11.1) and port number (default is 1445) of the robot, and click "Connect". Click "Connect" as shown in Figure 3-1.

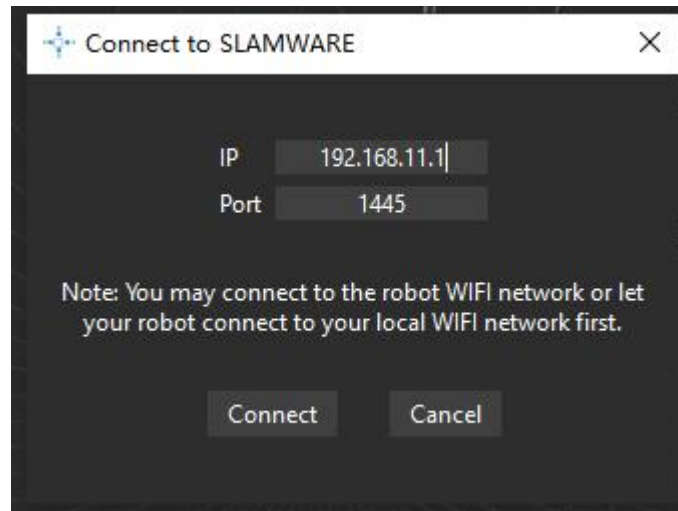


Figure 3-1 Manually connecting to the robot pop-up

Mode 2: If you have connected before, you can click "Manual Connecting History" in the robot panel, select the machine you want to connect, and click "Connect". As shown in Figure 3-2.

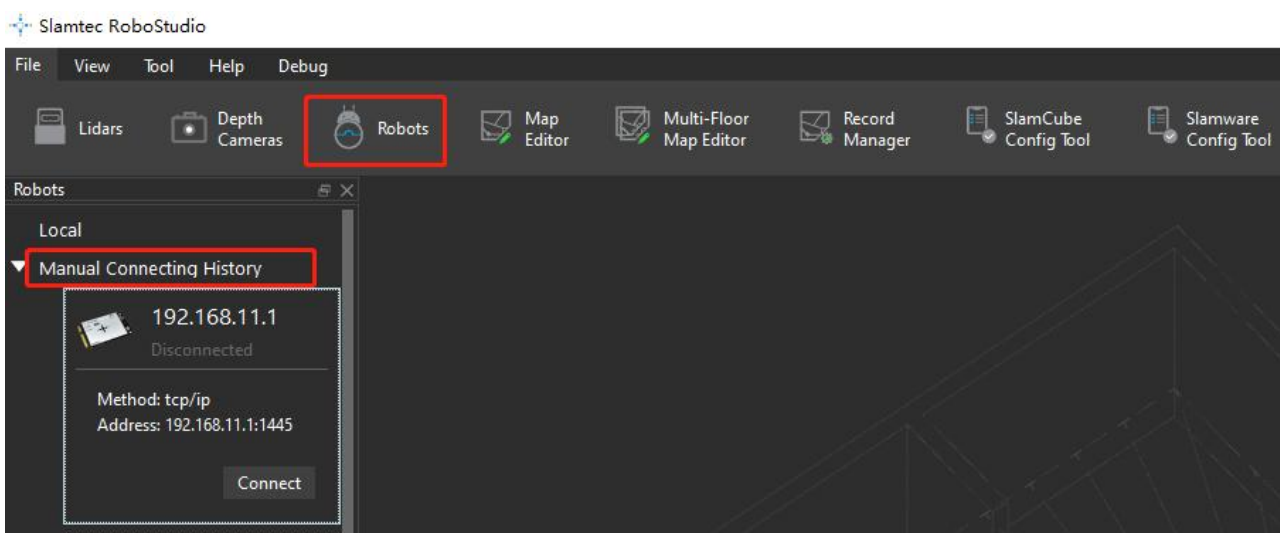


Figure 3-2 Connecting the Robot

3.2 Map preprocessing

In order to ensure the correctness and beauty of the map, once the map is created, it can be pre-processed through "Map Editor" -> "Eraser". The map data is divided into three main colors, white for known obstacle-free areas; gray for undetected areas,

where the presence of obstacles is unknown; and black for obstacle areas. Similar to the map data, the eraser also has three colors. Common scenarios that require preprocessing are as follows.

3.2.1 Double wall treatment

The phenomenon of very long double walls in the map can affect robot localization.

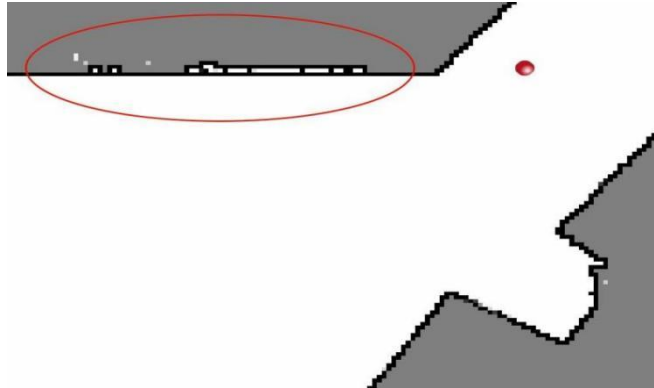


Figure 3-3 Double wall before trimming



Figure 3-4 Double wall after trimming

3.2.2 Dynamic Feature Erasure

If moving obstacles, such as carts, are built into the map during the build process, they need to be erased.



Figure 3-5 Before Dynamic Feature Erasure



Figure 3-6 After Dynamic Feature Erasure

3.2.3 Room door closure treatments

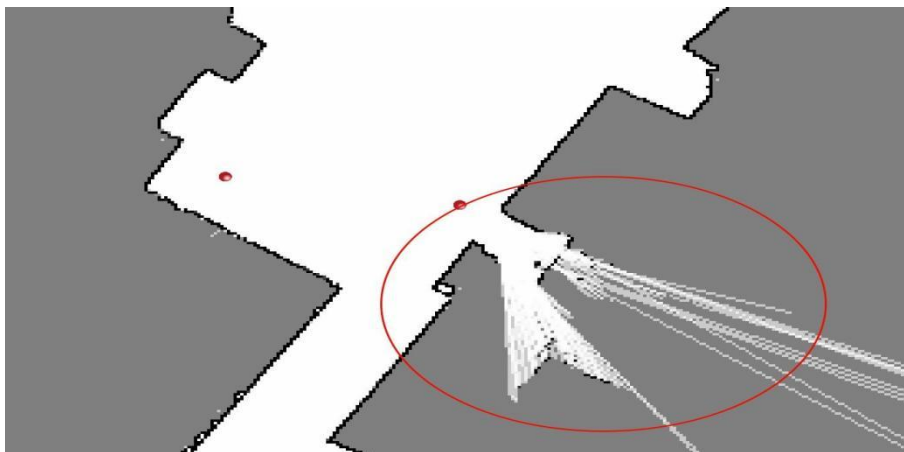


Figure 3-7 Room Door Before Closure Treatment



Figure 3-8 Room Door After Closure Treatment

3.2.4 Adding virtual tracks

Note: If Navigation mode is set to Free mode, you don't need to add a virtual track.

Select the virtual track in RS, draw the virtual track in the middle of the road that needs to be traveled, the robot goes on the track by default, and you need to draw the track on the points involved in RS (the track tries not to create loops).

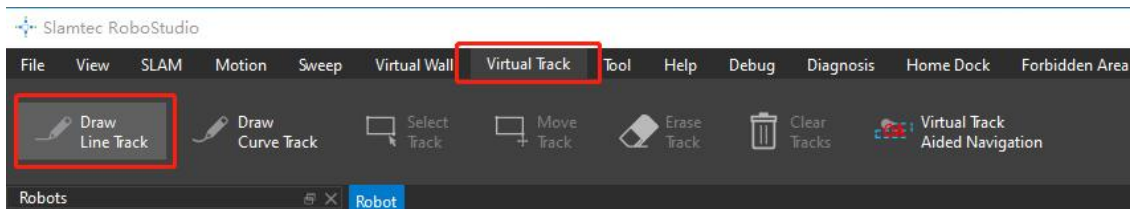


Figure 3-9 Adding a Virtual Track

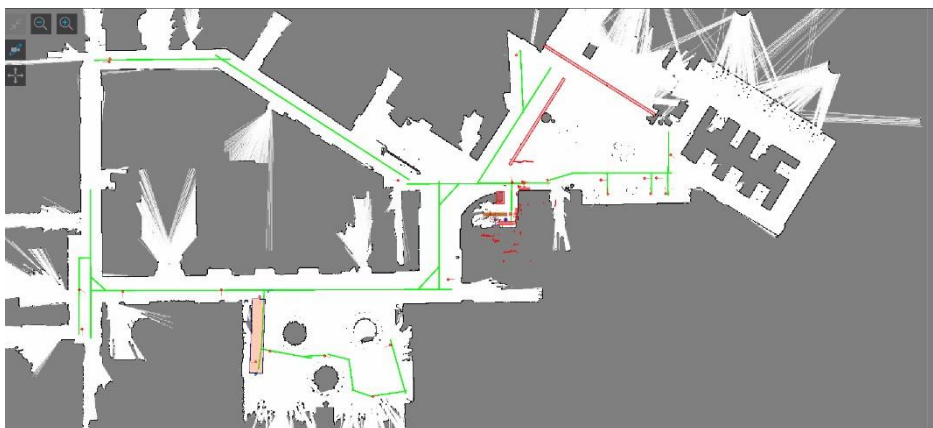


Figure 3-10 Virtual Track

3.2.5 Adding Virtual Forbidden Area

Virtual Forbidden Area: A virtual technology is used to artificially define an area that contains an escapeable area and a core area. Under normal circumstances, the robot will not navigate to the forbidden area; when the machine is located in the forbidden area, the robot will determine whether it is currently located in the escapable area or the core area, and then escape on its own.

Common ones that can be marked as forbidden area are commonly listed below:

- 1) dangerous areas (including steps, ramps greater than 5 degrees, building areas, and other dangerous areas)
- 2) Areas affecting robot work and production (Depending on the actual situation)
- 3) Areas that the robot will not reach (depending on the actual situation) Notes:
 - 1) For restricted area within the robot's activity area, we recommend covering them with virtual forbidden area
 - 2) If the wall is not recognized by the lidar, we recommend to draw a virtual forbidden area with a width of 20cm to cover as an obstacle.
 - 3) If the wall is recognized by the lidar, the virtual forbidden area no need to be created.

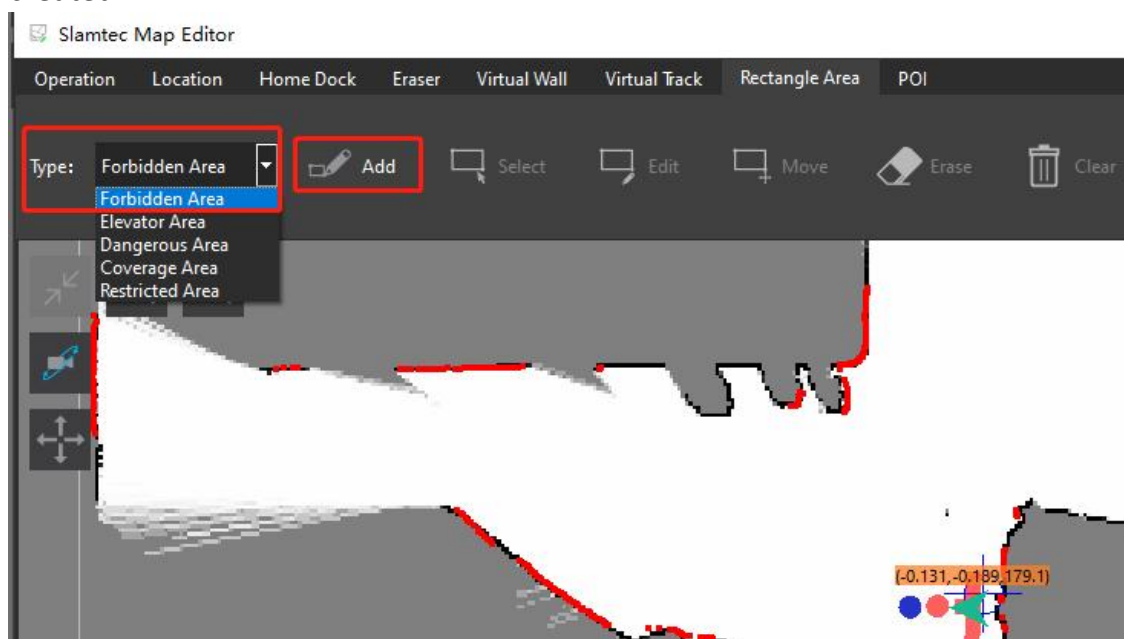


Figure 3-11 Adding the forbidden area

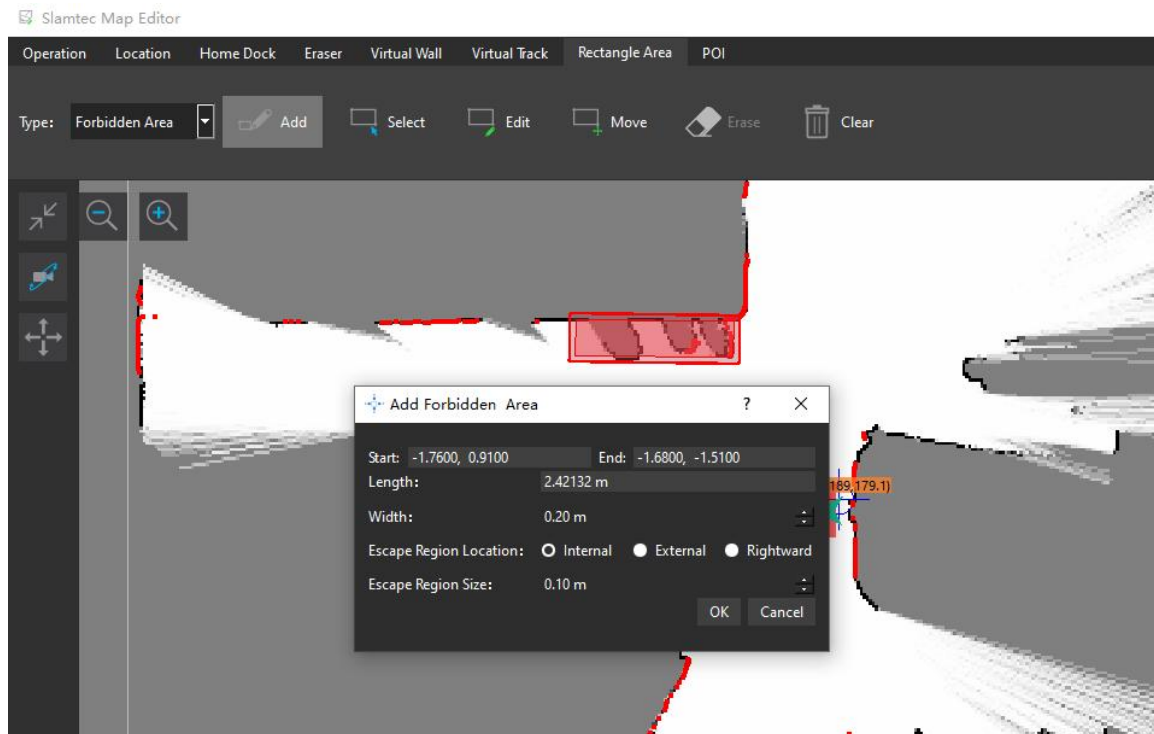


Figure 3-12 Schematic of forbidden areas

1. "Start": The position of the cursor on the map when the user clicks;
2. "End": the position of the cursor on the map when the user releases the mouse;
3. "Length": the distance between the start and end points;
4. "Width": can be changed by the user to indicate the degree of the forbidden area or internal forbidden area;
5. "Escape Region Size": Indicates the internal escape region in the forbidden area between the escape region and the boundary of the forbidden area.

3.2.6 Adding restricted areas

If more than one robot is running in a work area at the same time, and the actual scene of the work area has a narrow road, alley, etc. that can only be passed by one robot, a restricted area can be used (depending on the needs of the site).

How to add a restricted area:

1. Inside the map editor, select the rectangular area
2. Type Select [Restricted Area]
3. Drawing into a narrow path or alleyway

Note: Restricted areas need to be used with multiple robots.

3.2.7 Uploading maps

After finishing editing the map, click "Upload to Slamware" under "Operation", as shown in Figure 3-13 to upload the map to the robot.

Save the built map as a file in stcm file format, such as " myMap.stcm".

Maps saved locally can be used as backups.

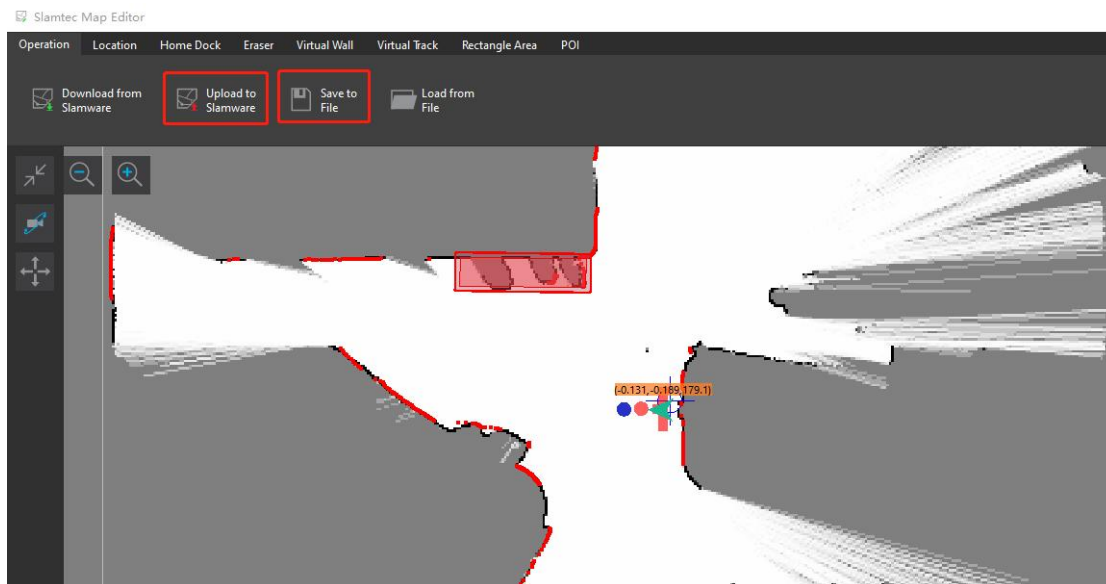


Figure 3-13 Map Upload

3.2.8 Save maps

After uploading to firmware, open Build map and click "**SAVE RS MAP**" to save the map edited by RoboStudio.

4. P3 Pro Operating Instructions

4.1 Home page

If the map loading is not successful, please push the robot to the charging station, as in Figure 4-1 long press the logo on the upper left corner to restart the software. If you need to push the robot, please press the brake button; after finishing, please recover, otherwise the robot cannot work.

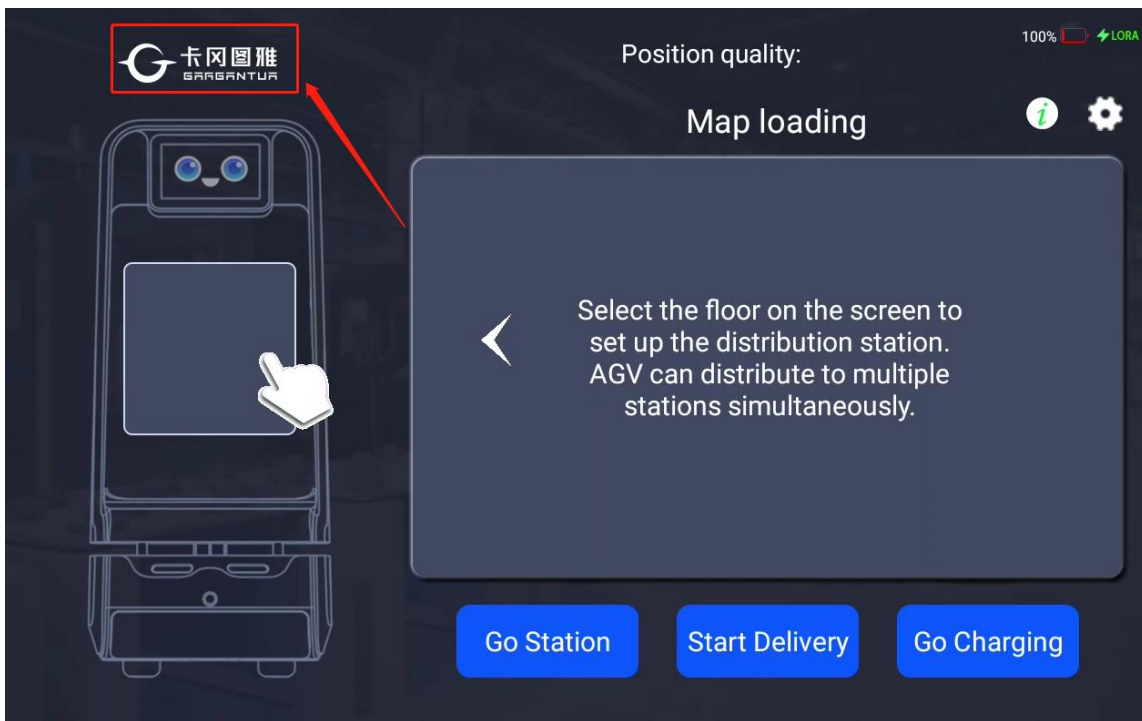


Figure 4-1 Long press to exit



Figure 4-2 Home Page

1) Step1

Click the button to open the settings page

2) Step2

a.Position quality: Position quality, the higher the value, the better the positioning

quality;

b.Brake: state of brake button, when the button is pressed down, the robot cannot work normally;

c.EStop: emergency stop button state, when the button is pressed, the robot cannot work normally;

3) Step3

Point selection area

4) Step4

Shortcut Function Buttons

4.2 Point selection area

Click on the hand indication area in Figure 4-2 to select the points to be delivered;

One or more points can be selected at a time, and the order of delivery is delivered in the order in which the points are selected;

After selecting the location for delivery, close the Select Points window.

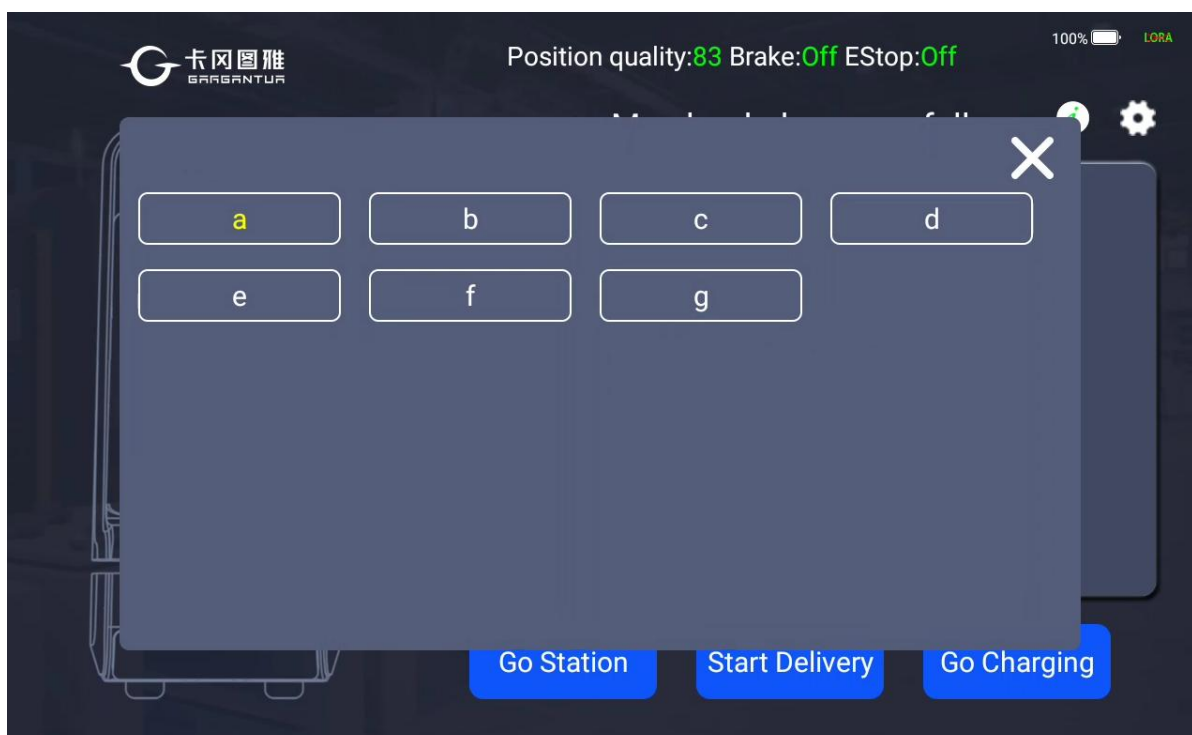


Figure 4-3 Point Selection Area

4.3 Creating Delivery Tasks

After selecting the delivery point, close the pop-up box in Figure 4-3 and click "Start Delivery" to create the delivery task.



Figure 4-4 Creating Distribution Tasks

4.3 Arrival at the destination point

After the robot arrives at the destination point, the screen displays the delivery status as in Figure 4-5;

At the same time, there is a voice announcement, suggesting that please pick up the goods. After picking up the goods, please tap "Completed", the robot will continue to the next point, if only one point to deliver, tap "Completed", the robot will go back to the station or set the workstation;

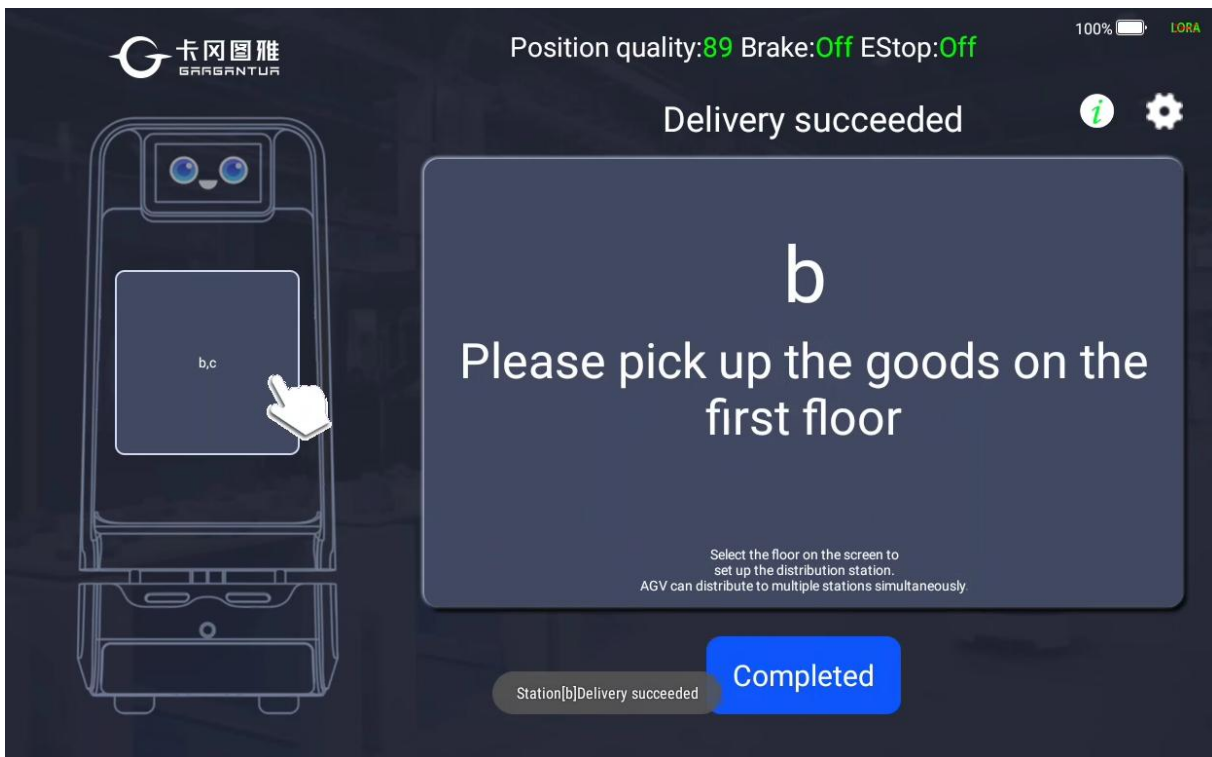


Figure 4-5 Arriving at a destination Point

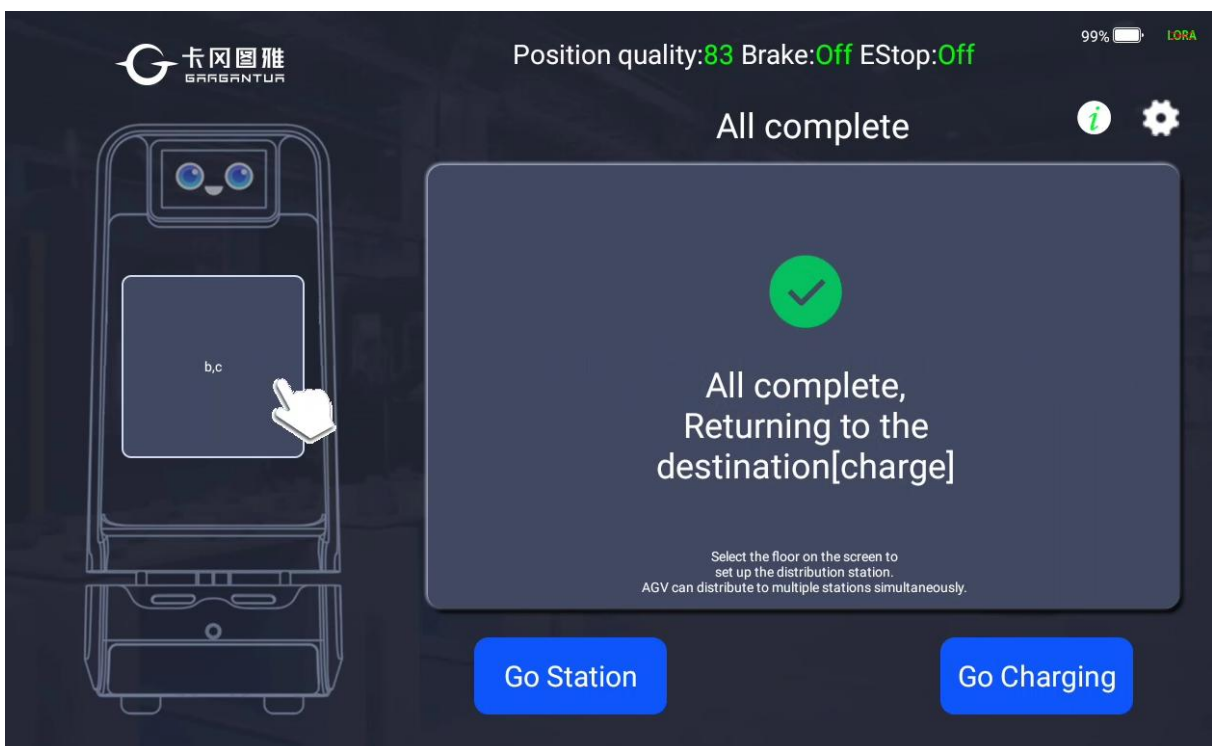


Figure 4-6 Completing the task, on the way back

4.4 Setup Page

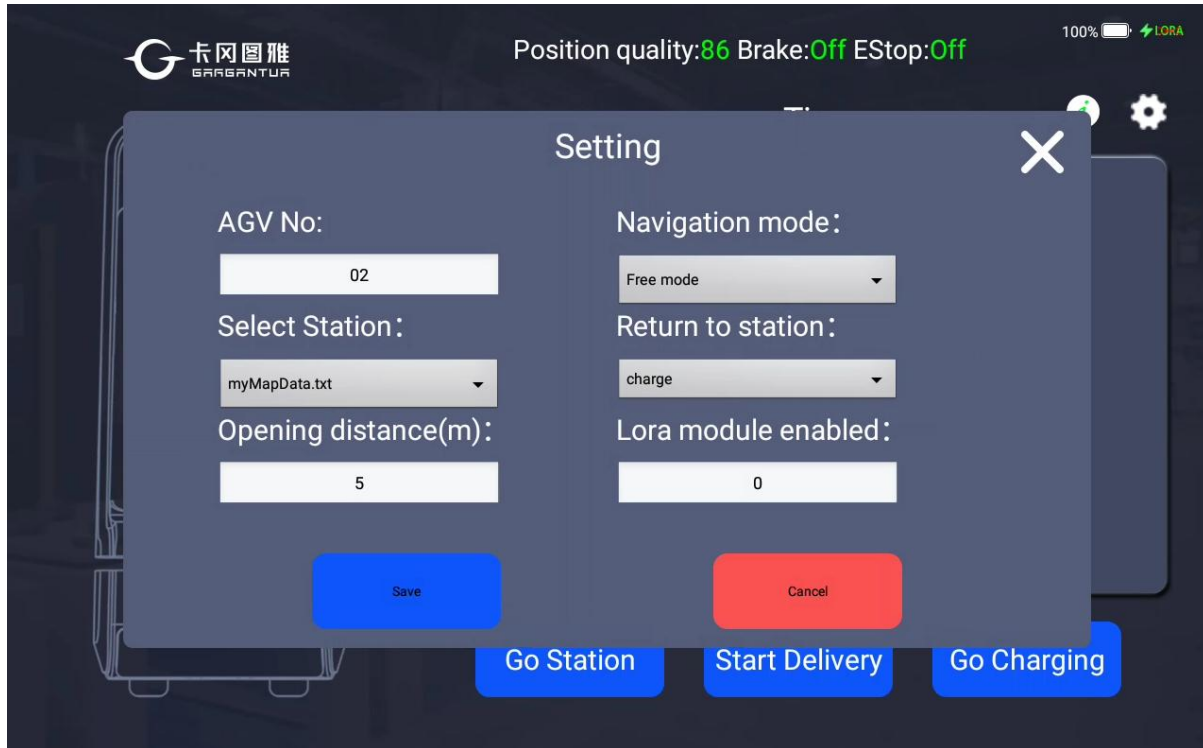


Figure 4-7 Setup Page

1) AGV No

Robot number for easy identification.

2) Select Station

Points are selected in multiple groups for zoning management.

3) Opening distance(m)

The motorized door module is configured to set the distance of the motorized door to call for opening when it is in the no-waiting-to-open mode.

4) Navigation mode

There are three Navigation modes allow to be selected.

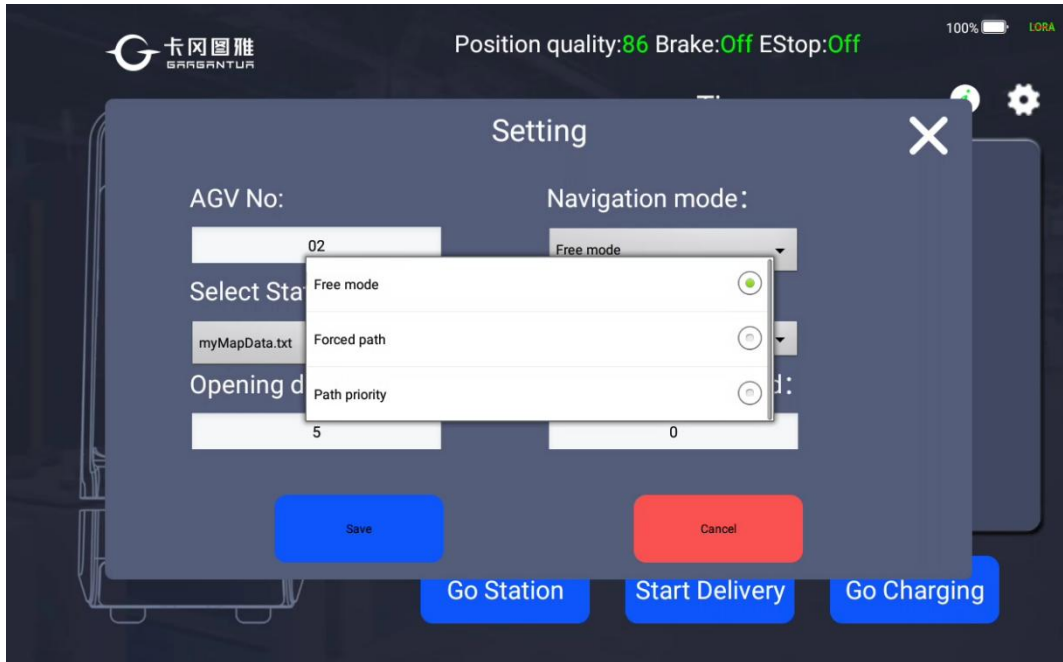


Figure 4-8 Navigation Mode Selection

5) Return to station

When the deliver task is completed, set the selection that the robot will return to the charging station or set station.

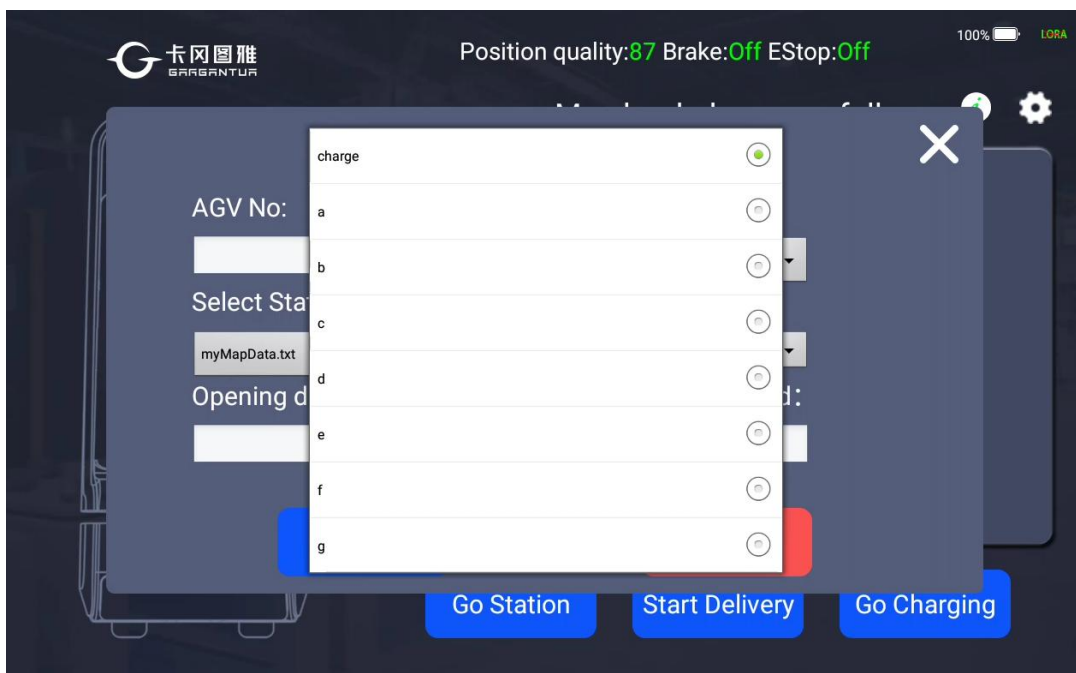


Figure 4-9 Setting the Return Point

6) Lora module enabled

Wireless communication module switch:

Value 0 : allows the system to operate normally regardless of whether the robot contains a Lora communication module;

Value 1: The robot will only work properly if it contains the Lora communication module, otherwise it will not work.

After completing the setting options, please click "Save" to save the modified configuration, after saving successfully, please exit the application and reboot to take effect.

FCC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

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 into 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.