SLAMTEC

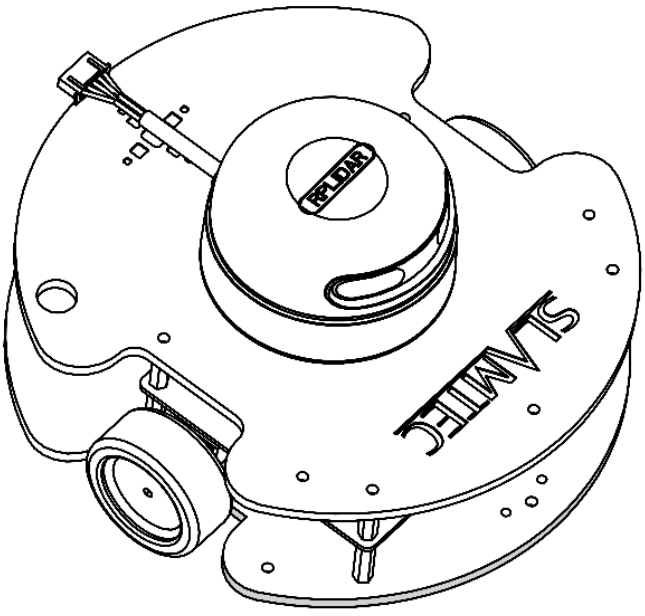
2024-07-06 rev.1.5

SLAMWARE

RoboStudio

User Manual

ROBOSTUDIO



www.slamtec.com

RoboStudio is an extendable desktop application for robot management and development. Developers can use it to build communication with robot and get robot's sensor data, pose, state and map information via interfaces provided by the robot. After reprocessing the collected data, RoboStudio can present it in a user-friendly interface. Users can also monitor and control the robot by sending commands to it via RoboStudio.

Offline/Online Mode

RoboStudio can work both online and offline.

Offline Mode

When there is no internet network connection, the RoboStudio will start with the prompt dialog box as in Figure 2.1.1. Please open the network adapter on computer and find the SSID hotspot of the robot as in Figure 2.1.2, and then click the SSID name and click **Connect** in the extended box. After connecting to the robot, please click the **Ignore** in Figure 2.1.1 to enter offline mode.

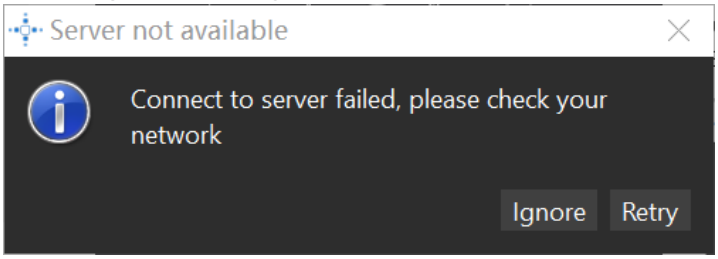


Figure 2.1.1 The prompt dialog box after launching offline

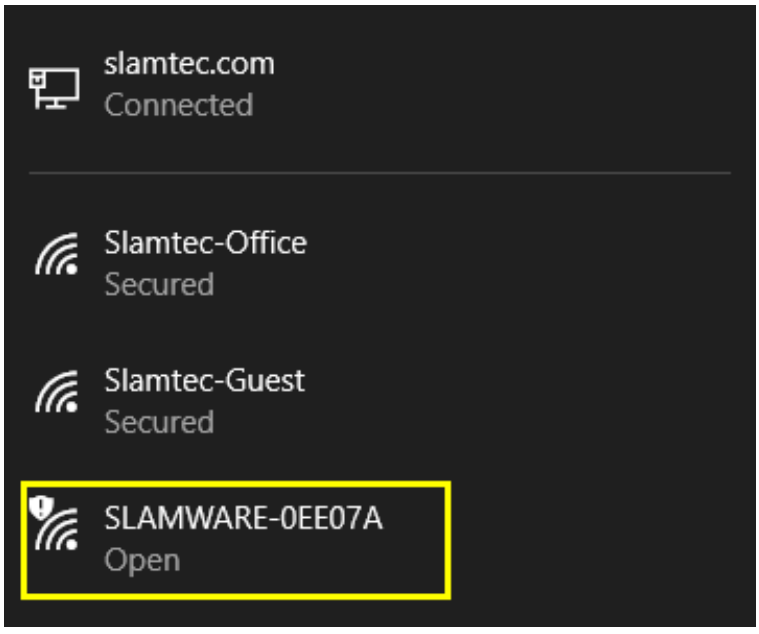


Figure 2.1.2 The SSID hotspot in network adapter

Online Mode

When there is internet network connection, after launching, RoboStudio will open its login page as in Figure 2.1.3. Users can open the register page as in Figure 2.1.4 by clicking Register to register a cloud account.

Figure 2.1.3 The login page

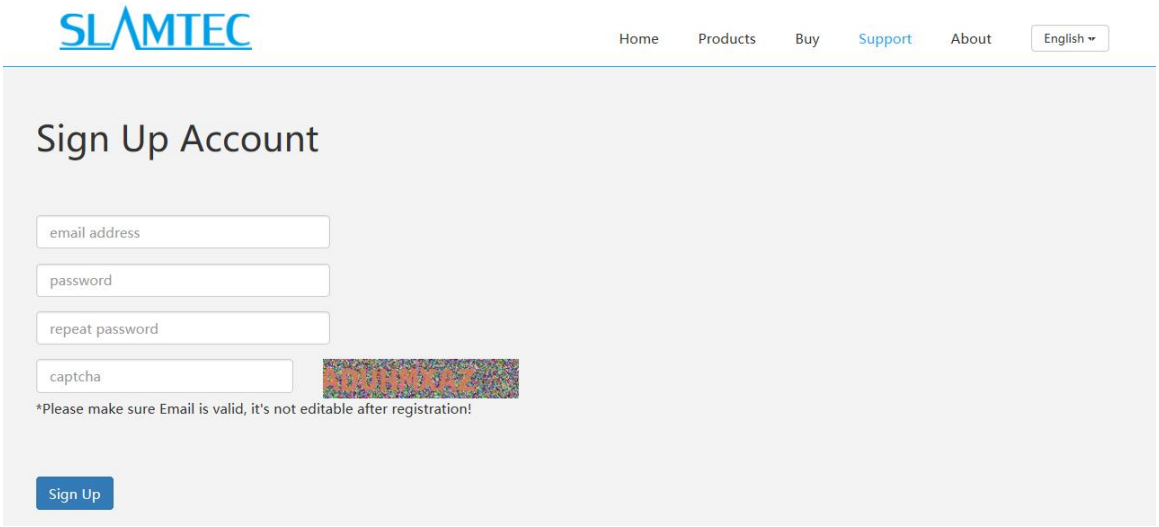


Figure 2.1.4 The register page

If the user already has a cloud account, just enter in the account and password and click **Go** to log in to the major interface.

As in Figure 2.1.5, the major interface has three parts:

1. Menu and tool bar

Menu and tool bar are in the top of the pane. Click a menu and its related buttons will list in the lower tool bar.

2. Cloud account

Cloud account setting is in the upper right corner. User can check the account information or log out of the current account.

3. Major work area

The central part of the pane. After connecting to the robot, it will show the robot, the map data and the status information.

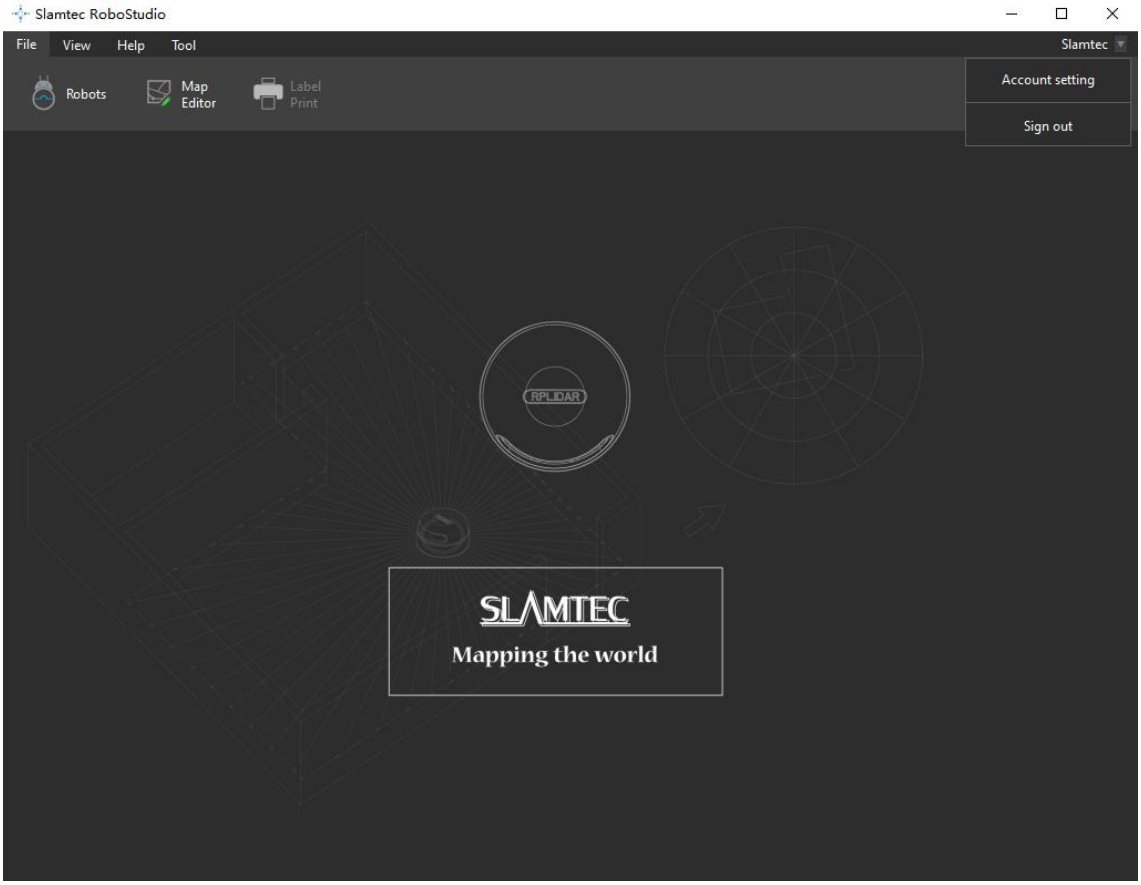


Figure 2.1.5 Major pane

Connect/Disconnect Robot

By clicking **File->Robots**, user can find a docked window opened in the left side of the pane as in Figure 2.2.1. In this window, user can connect to or disconnect from robots. Robots are grouped into two lists: **Local** and **Manual Connecting History**.

Local: RoboStudio will search for the available robots in local area network and list them in the local list.

Manual Connecting History: this history will list all robots which are connected via entering IP address and portal name.

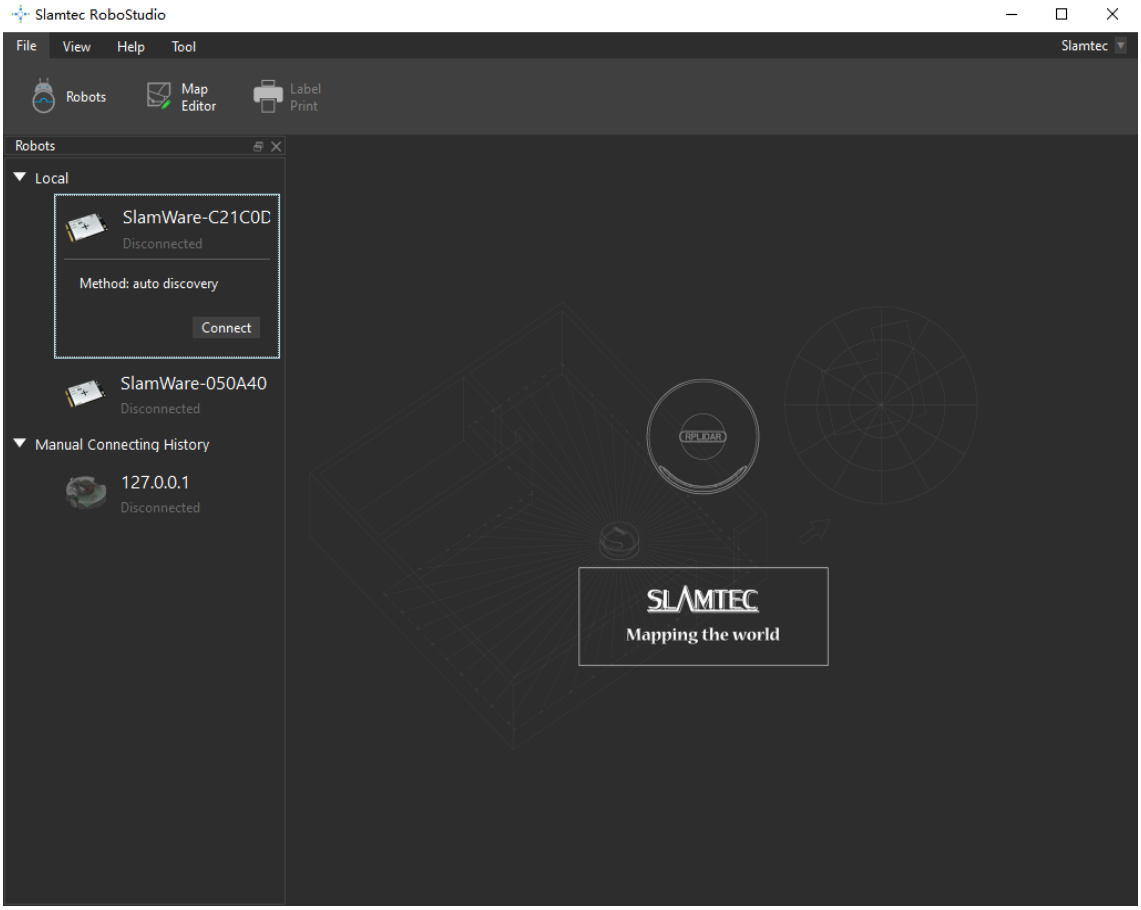


Figure 2.2.1 Docked window

User can connect to the robot via the following method:

Find the robot in the **Local** list or **Manual Connecting History** list, click the robot name to extend it, and then click **Connect** to connect to the robot (as in Figure 2.2.2).

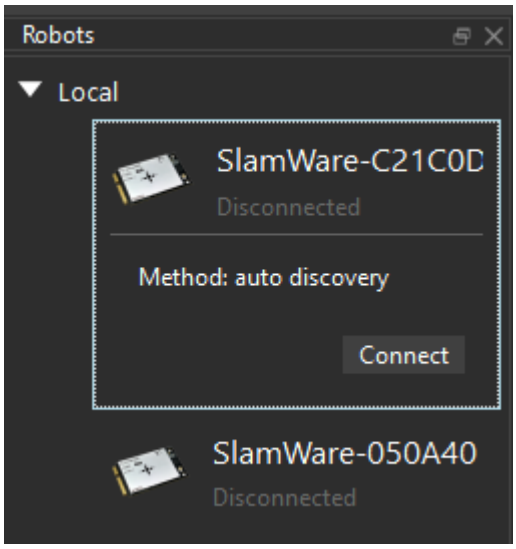


Figure 2.2.2 Connection by Connect button

Right click the whitespace of the robot list, and enter the IP address and port number in the prompt dialog box, then click **Connect** to connect to the robot (as in Figure 2.2.3).

Figure 2.2.3 Manual connection

Once connected successfully, the major work area will show the robot, map information and its status. The robot name will turn to green and the robot status will turn to **Connected** (as in Figure 2.2.4)

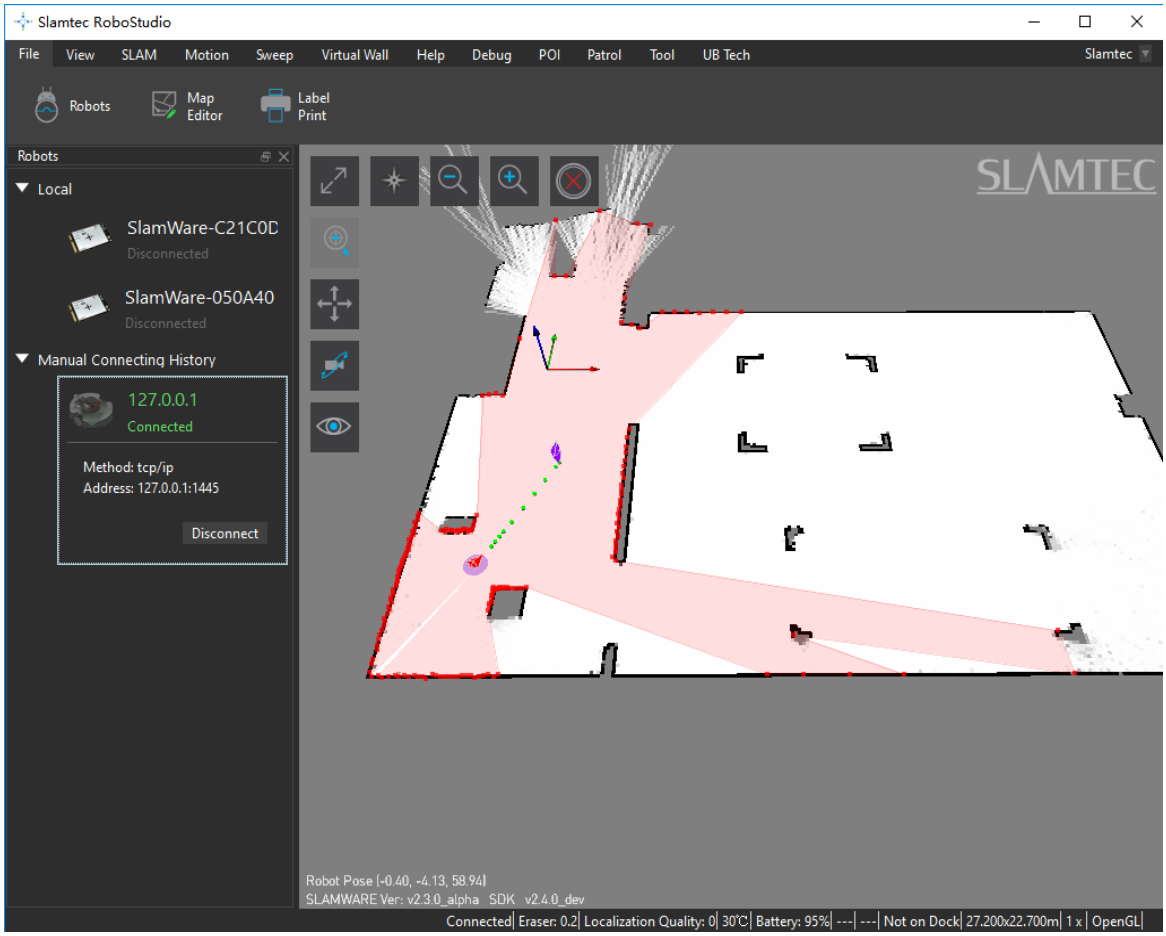


Figure 2.2.4 Successful connection

Right-click the robot name and choose **Disconnect** to disconnect from robot from RoboStudio. The major work area will go back to the initial window as in Figure 2.2.1.

If a robot lose connection accidently, the major work area will keep its current map for a while and the RoboStudio will try to reconnect for five times which will be shown in the bottom status bar. RoboStudio will disconnect from the robot after it fails for five times in reconnection, and go back to the initial window.

When switching to a different network, the robot list in the local list will reset quickly and it will not affect the connected robots.

User can edit the robot information by right clicking the robot name and choosing **Edit Robot**. In the pop-up dialog, user can edit the robot name and its thumbnail (as in Figure 2.2.5).

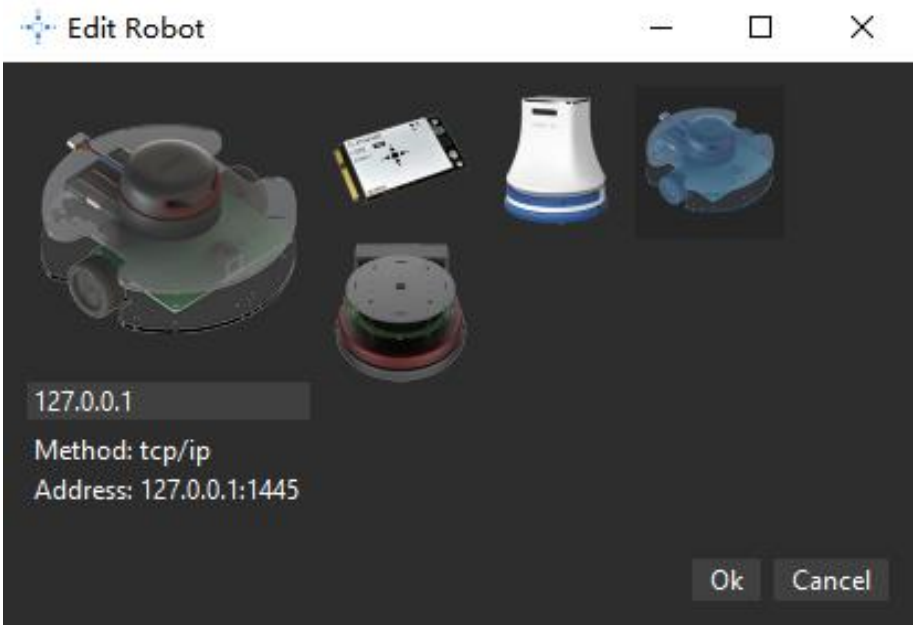


Figure 2.2.5 Edit Robot

Switch View

In default work mode, user can switch the map view via the following method:

1. hold the left mouse button down and drag to rotate the map;
2. hold the right mouse button down and drag to translate the map;
3. scroll up the mouse wheel to zoom in and zoom out (User can also click the magnifying glass icon to zoom in or zoom out, as in Figure 2.3.1);
4. click the icons in the major work area, as in Figure 2.3.1.

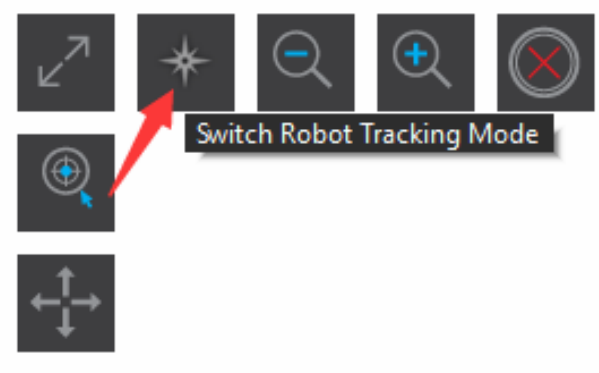


Figure 2.3.1 View Mode Switch

Move Robot

RoboStudio can control the robot to move in different ways. It is easy to make the robot move to an undiscovered place. It will find path and move to the target place automatically, with no need to worry about the obstacles in the way.

Left Mouse Button:

In the navigation mode, left click any place in the map to create a new target, and the robot will cancel all the existed targets and restart to find path and navigate to the new target.

Shift + Left Mouse Button:

In the navigation mode, hold **Shift** key down and left click any place on the map to add a new target in the end of current target list, and the robot will move to the added target after finishing all the moving task created before.

Go home:

Click **Motion**-> **Go Home**, the robot will go back to the origin of coordinate. It will first search for the matched charging base near the origin, and dock to the charging base automatically once find it.

Basic move:

Click **Motion**-> **Turn Left/Turn Right/Move Forward/Move Backward**, or press the left/right/up/down arrow keys on the keyboard, the robot will turn left, turn right, move forward or move backward.

Stop:

Right click any place in the map twice, or click the **Cancel Action** button in the major work area. The robot will stop running.

Set way point:

Click **Motion**-> **Set Way Point** in the menu to enter setting way mode, and then hold left mouse button down and drag to create a black path as in Figure 2.4.1. After releasing the mouse button, a string of target points will be created in the map for the robot to follow up.

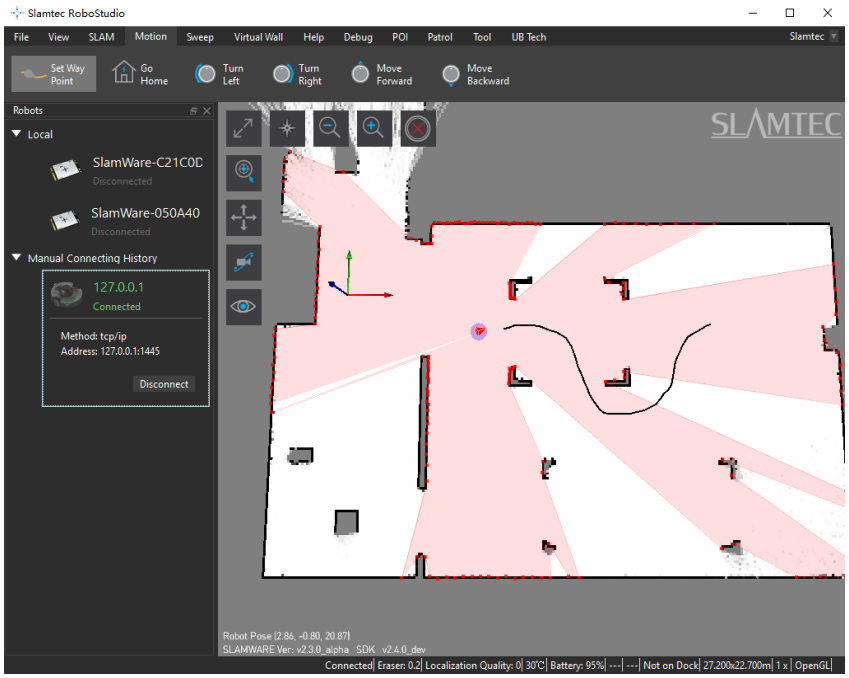


Figure 2.4.1 View Mode Switch

Localization & Mapping

SLAM(simultaneous localization and mapping) is the key technology of SLAMTEC, so RoboStudio also provides related service for users.

Map Related Function

The mobile robot of Slamtec is designed based on grid map SLAM. While walking, the robot can explore and update map continuously in its “cerebellum”.

In RoboStudio, the gray value of every pixel cell indicates the probability of being obstacles. White indicates no obstacle, and black obstacles. When mapping, the color of every pixel is not always be white or black. For example, the undiscovered place, where whether there is obstacles is unknown, is grey in the map.

With RoboStudio, user can use the following method to wash the brain of robot and edit its map manually.

Map Eraser

Click **SLAM->Map Eraser White/Map Eraser Grey** in the top menu bar, hold left mouse button down and drag to set some part of the map as white or grey.

Clear Map

Click **SLAM->Clear Map** in the menu bar, choose **Yes** in the prompt dialog box to clear the whole map (as in Figure 2.5.1).

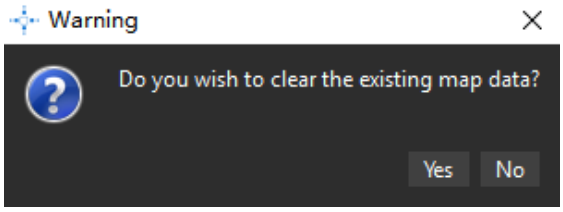


Figure 2.5.1 Clear Map Data

Sync Map

In the default mode, RoboStudio can update the map data in the area surrounding the robot. User can also update the whole map by clicking **SLAM->Sync Map** in the menu bar if required.

Map Editor

Click **SLAM->Map Editor** to open the Map Editor as in Figure 2.5.2.

Map Editor can load supported map files (including picture format), and upload them to the robot firmware, it can also download robot map and save it as map file. User can drag the origin of coordinate and pose of robot to the discovered place, therefore the robot can be in a discovered place once launched.

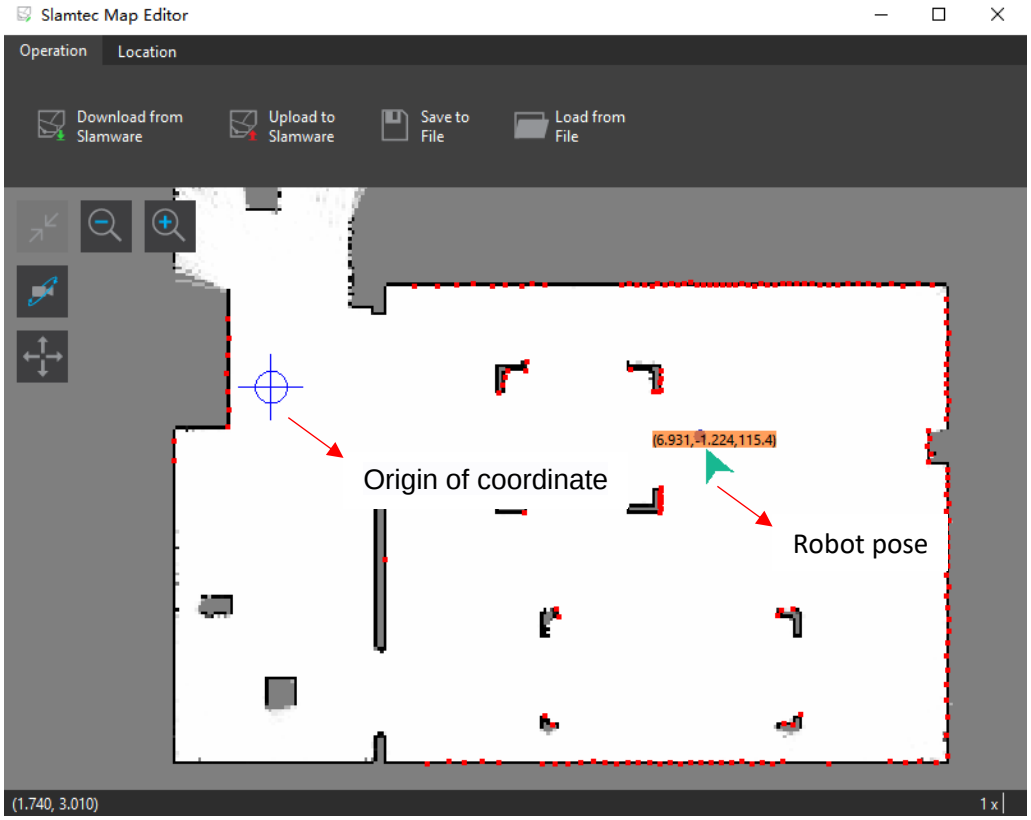


Figure 2.5.2 Map Editor

Recover Localization

As in Figure 2.5.3, when the robot is picked up or has position deviation, recovering localization is more useful than setting or adjusting the map manually.

Recovering localization requires the RoboStudio has the recovering localization plug-in installed and connected to the device which supports recovering localiztaion feature.

Click **SLAM**-> **Recover Localization** in the top menu bar and select the efficient area (It is very likely that the robot is in this area) in the map, as in Figure 2.5.4, then the robot will start recovering localization in the efficient area. The robot will recover its pose and localization once recovering localization finished, as in Figure 2.5.5.

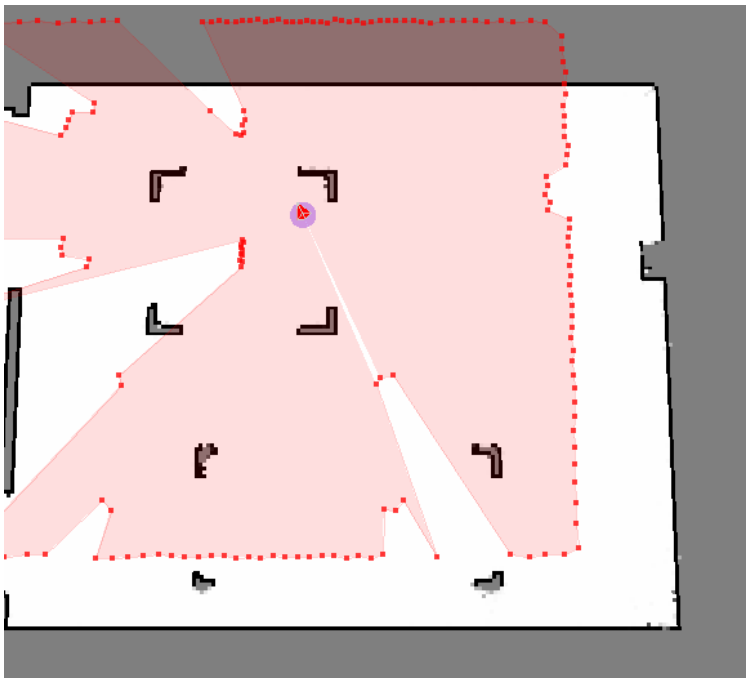


Figure 2.5.3 Localization Deviation

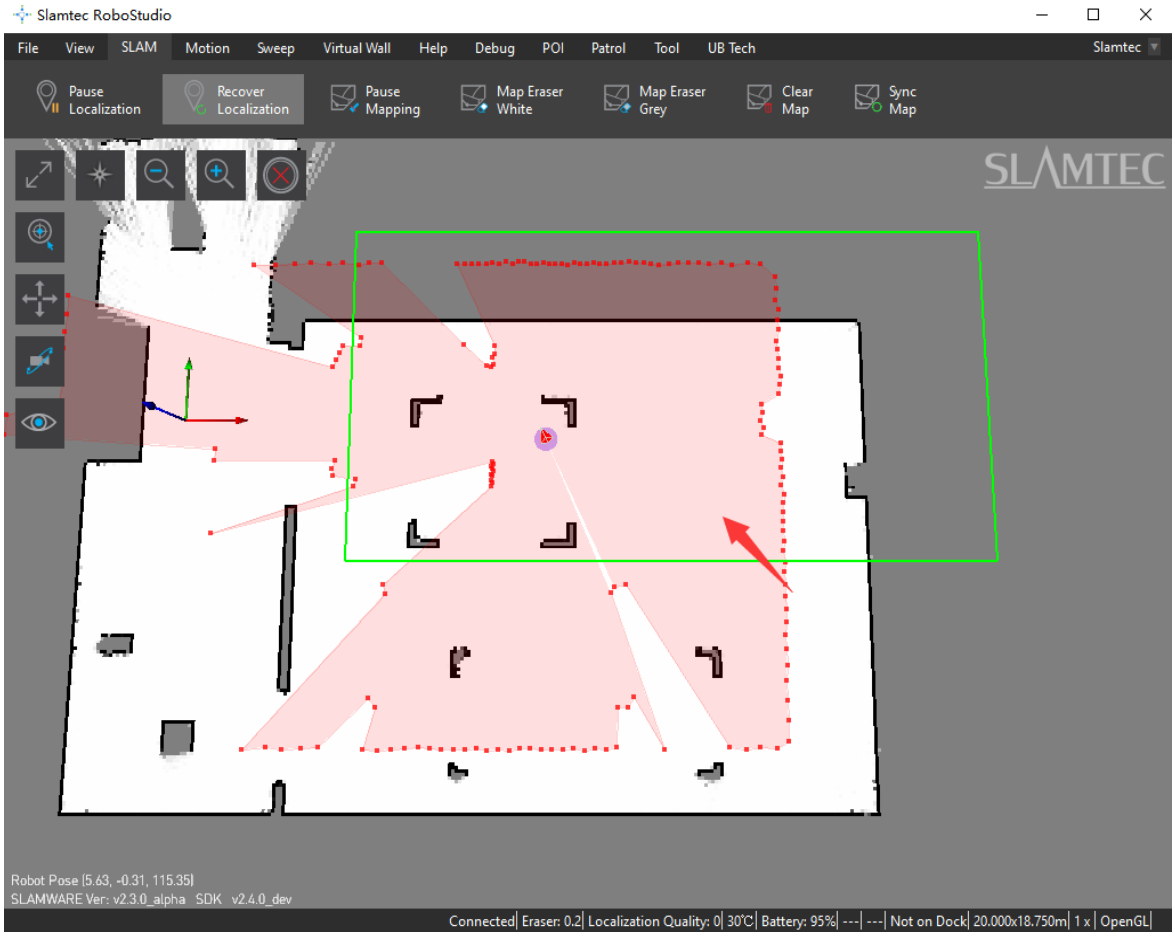


Figure 2.5.4 Select efficient area

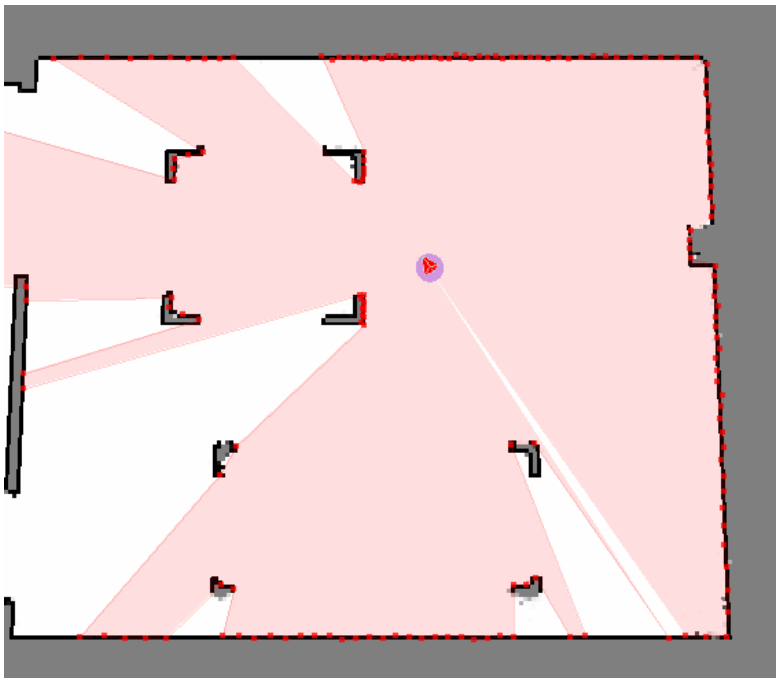


Figure 2.5.5 Localization recovered

Virtual Wall Management

Virtual wall technology, mainly developed based on software, with no additional accessory devices, can make mobile robots take the virtual walls as real obstacles and limit its working area. This low-cost technology can create high-resolution virtual walls and change their shape easily.

RoboStudio can communicate with the robot and add, edit or remove the virtual walls in the map of the robot. The robot will take the virtual walls as real walls and avoid them when running.

Add Virtual Wall

Click **Virtual Wall** -> **Draw Line Wall** / **Draw Rectangle Wall** / **Draw Curve Wall** in the menu and then left click a point in the map and drag to create different virtual walls, as in Figure 2.6.1.

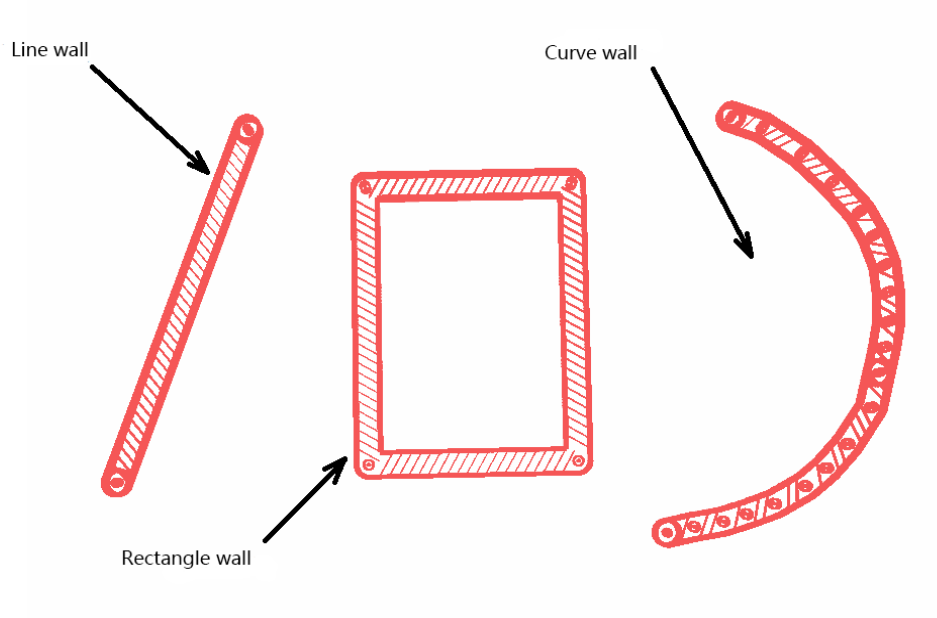


Figure 2.6.1 Different Virtual Walls

Move Virtual Wall

Click **Virtual Wall** -> **Select Wall** in the menu and then choose a virtual wall (use the mouse to click a virtual wall or drag an area). Click **Move Wall** to enter moving mode, then left click any point in the map and drag the virtual wall to the target, after releasing the mouse button, the virtual wall will be in the target place, as in Figure 2.6.3.

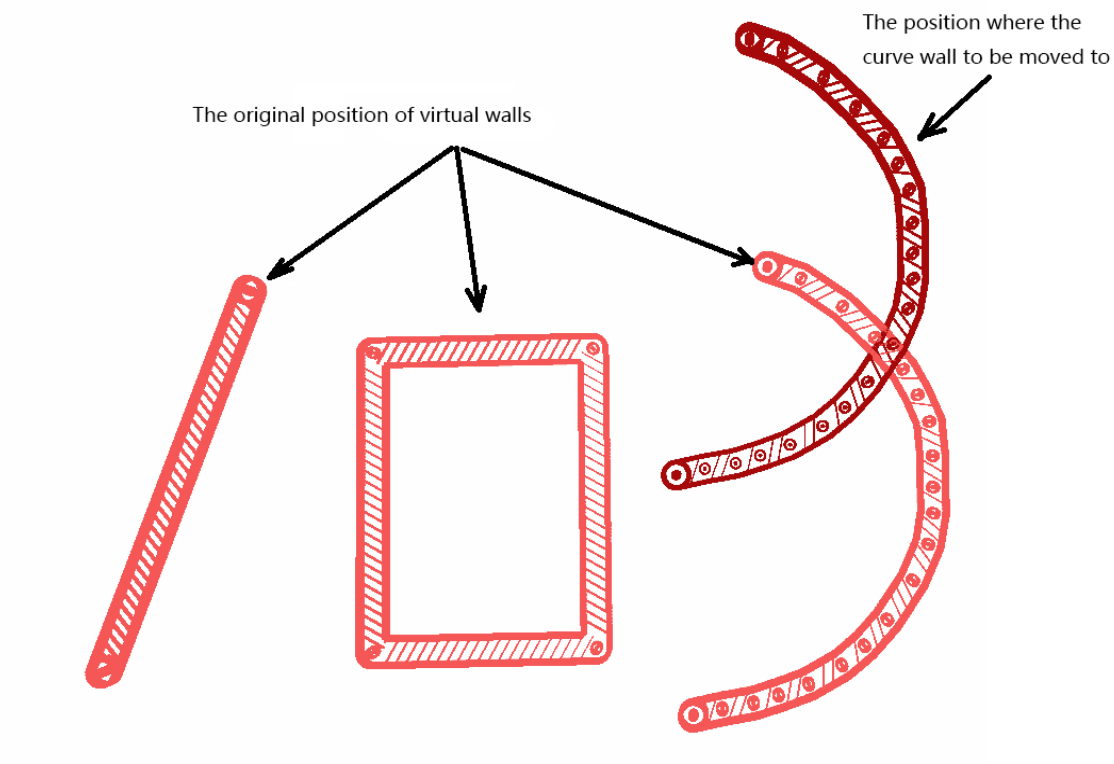


Figure 2.6.2 Drag the virtual wall to a new place

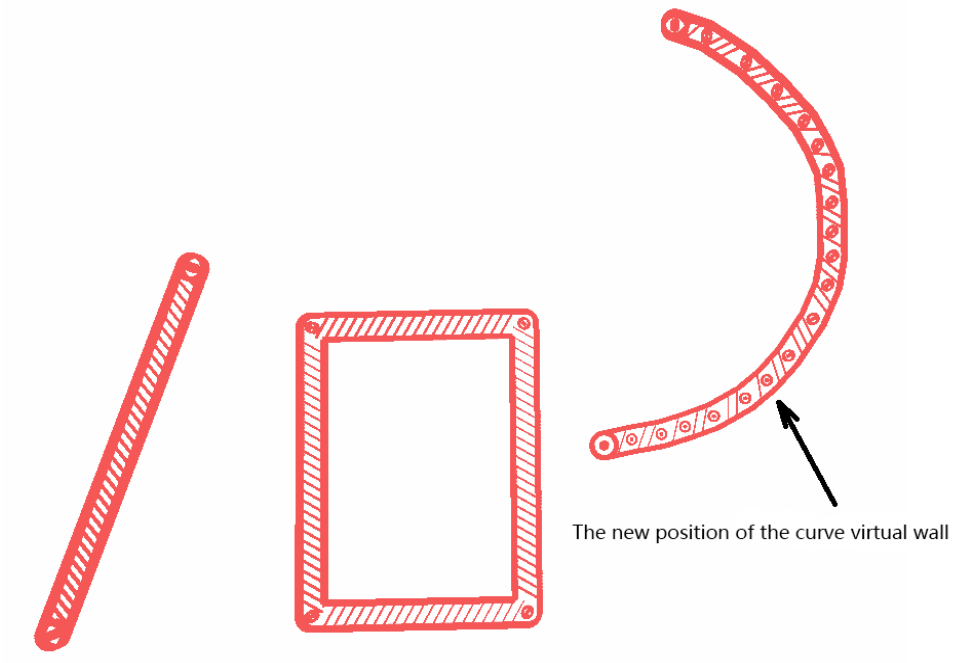


Figure 2.6.3 The virtual wall has moved to a new place

Edit Virtual Wall

The same as moving virtual wall. Click **Virtual Wall** -> **Select Wall** in the menu and then choose a virtual wall. Click **Move Wall** to enter editing mode, then left click the endpoint or node of the virtual wall and drag it to the target place, after

releasing the mouse button, the shape of the virtual wall will change as in Figure 2.6.4.

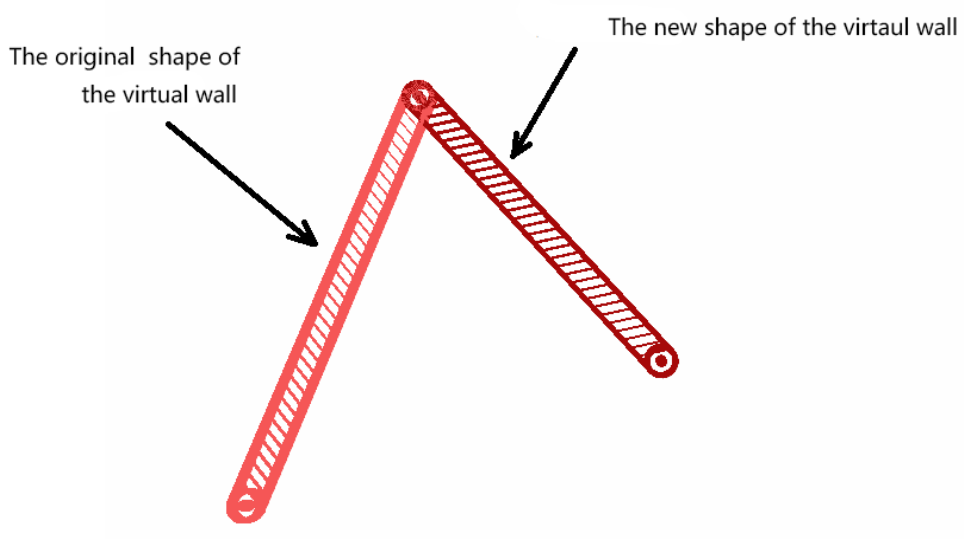


Figure 2.6.4 Choose the virtual wall and drag its endpoint

Delete Virtual Wall

Click **Virtual Wall** -> **Select Wall** in the menu and then choose virtual wall(s). Click **Erase Wall** to delete chosen virtual wall(s) and click **Clear Walls** to delete all the virtual walls.

Virtual Track Management

Similar to the virtual wall, virtual track technology, mainly developed based on software, with no additional accessory devices, can make mobile robots patrol on a fixed track intelligently, which can apply in mobile robots food delivery, patrol, monitor or industry production.

RoboStudio can communicate with mobile robots and add, edit or delete virtual tracks in the maps they build. . During path finding, the robot will search the nearest key points of virtual track from the start point, and calculate the shortest virtual track path to the target, then navigate to the target autonomously, smoothly and avoid obstacles in the way.

The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.

Add Virtual Track

Click **Virtual Track** -> **Draw Line Track** / **Draw Curve Track** in the menu and then left click a point in the map and drag to create different virtual tracks, as in Figure 2.7.1.

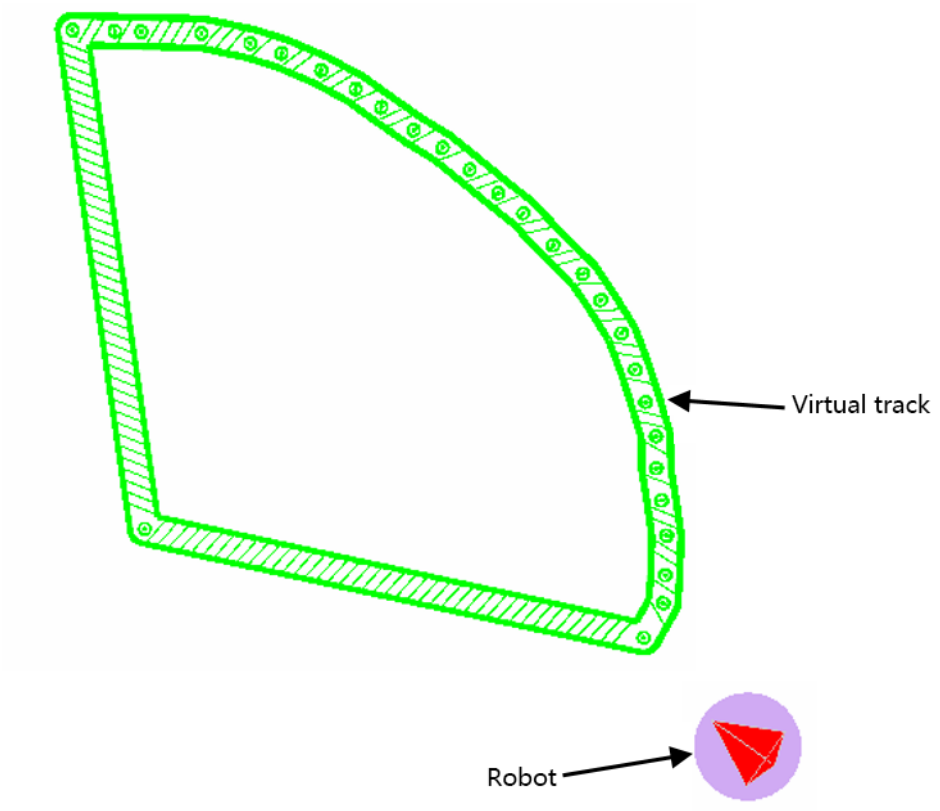


Figure 2.7.1 Virtual Track

Move Virtual Track

Click **Virtual Track** -> **Select Track** in the menu and then choose a virtual track (use the mouse to click a virtual track or drag an area). Click **Move Track** to enter moving mode, then left click any point in the map and drag the virtual track to the target, as in Figure 2.7.2, after releasing the mouse button, the virtual track will be in the target place, as in Figure 2.7.3.

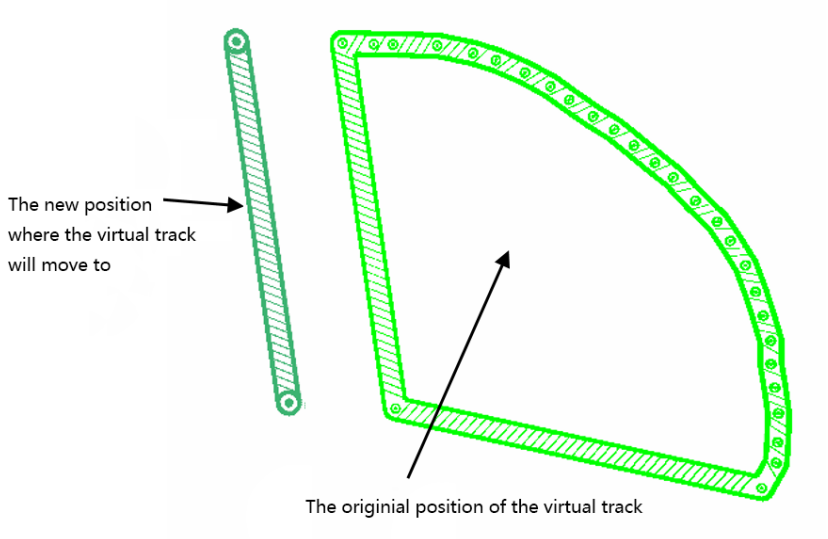


Figure 2.7.2 Choose and drag a virtual track

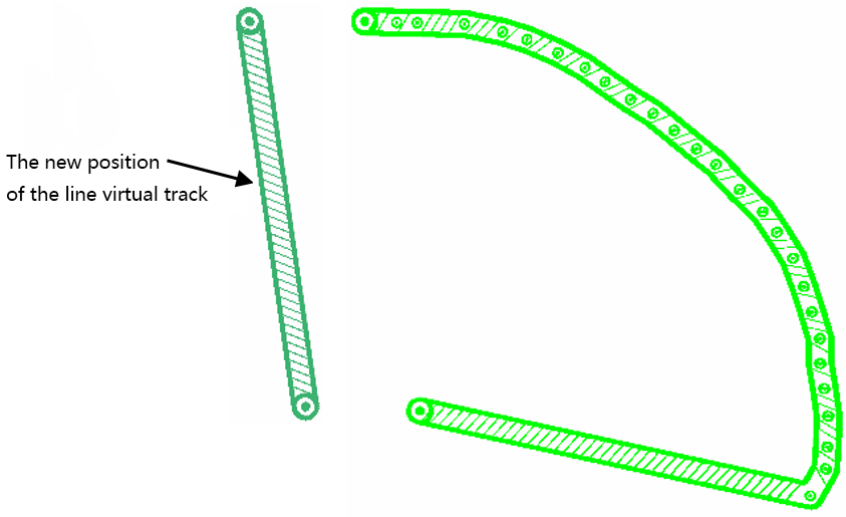


Figure 2.7.3 The virtual track has moved to a new place

Edit Virtual Track

The same as moving virtual track. Click **Virtual Track** -> **Select Track** in the menu and then choose a virtual track. Click **Move Track** to enter editing mode, then left click the endpoint point or node of the virtual track and drag it to the target place, after releasing the mouse button, the shape of the virtual track will change as in Figure 2.7.4.

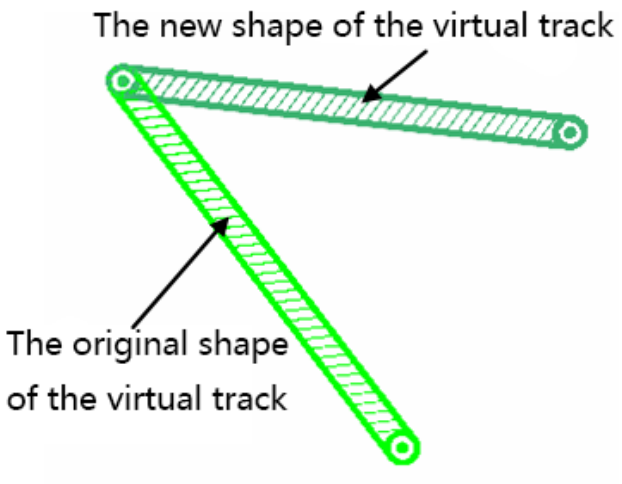


Figure 2.7.4 Localization recovered

Remove Virtual Track

Click **Virtual Track** -> **Select Track** in the menu and then choose virtual track(s). Click **Erase Track** to delete those chosen virtual track(s) and click **Clear tracks** to delete all the virtual tracks.

Virtual Track Navigation

In the default navigation mode, as in Figure 2.7.5, the virtual track will not influence the robot's path finding. When clicking the **Navigate by Track** button as in Figure 2.7.6, the robot will enter virtual track navigation mode. If set a target for the robot in this mode, the robot will search the nearest key points of virtual track from the start point, and calculate the shortest virtual track path to the target, then navigate to the target autonomously, smoothly and avoid obstacles in the way, as in Figure 2.7.7. In this mode, the **Shift** key is still valid.

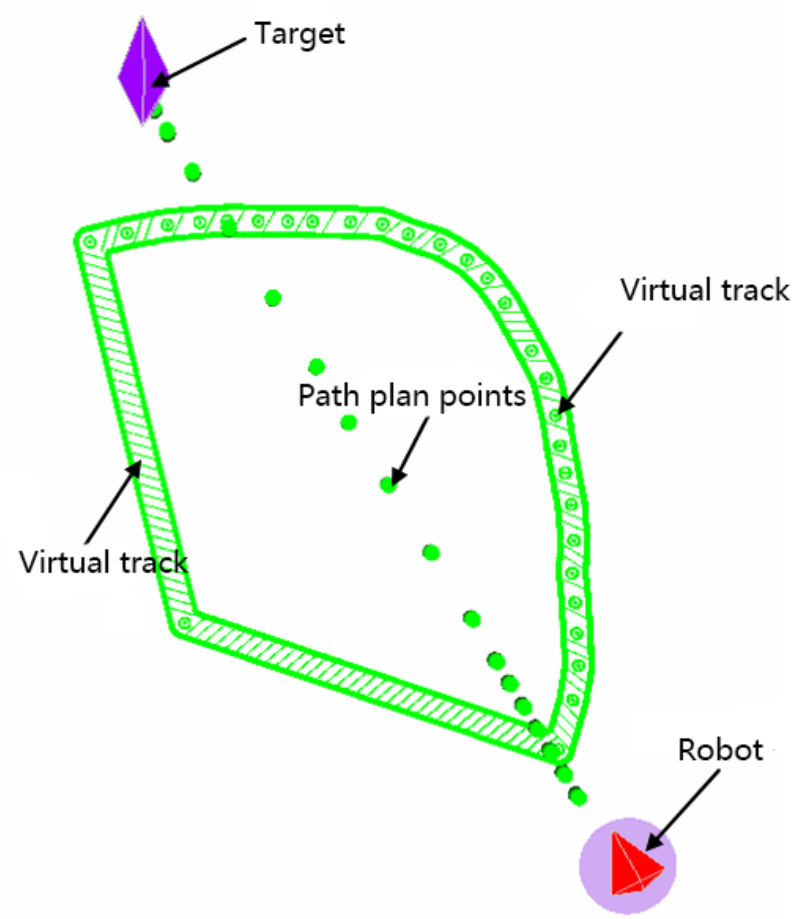


Figure 2.7.5 Path finding in normal navigation mode

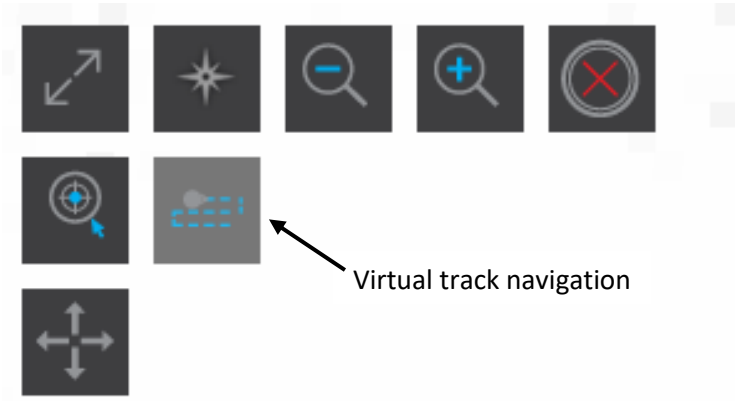


Figure 2.7.6 Virtual track navigation button

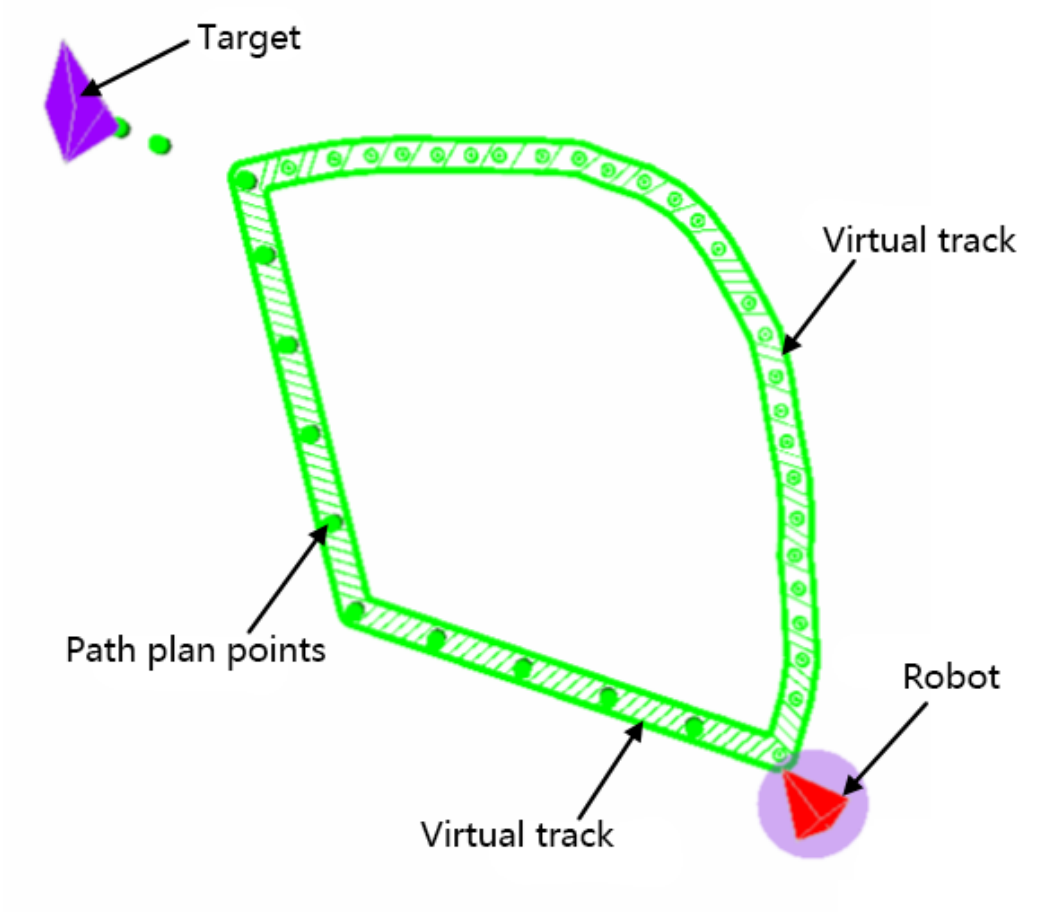


Figure 2.7.7 Path finding in virtual track navigation mode

Virtual Track Aided Navigation

Click **Virtual Track -> Virtual Track Aided Navigation** in the toolbar of the menu bar, and click **Navigate By Track** in the upper left corner of the work area as shown in Figure 2.7.8 to enter the virtual track aided navigation mode.

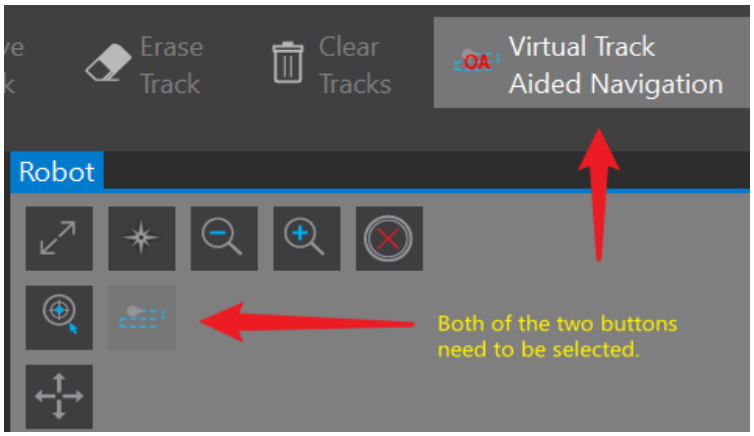


Figure 2.7.8 Virtual Track Aided Navigation button

As shown in Figure 2.7.9, different from virtual track navigation, in the virtual track aided navigation mode, the robot will go down the track to bypass the obstacles rather than stop if there are obstacles on the way.

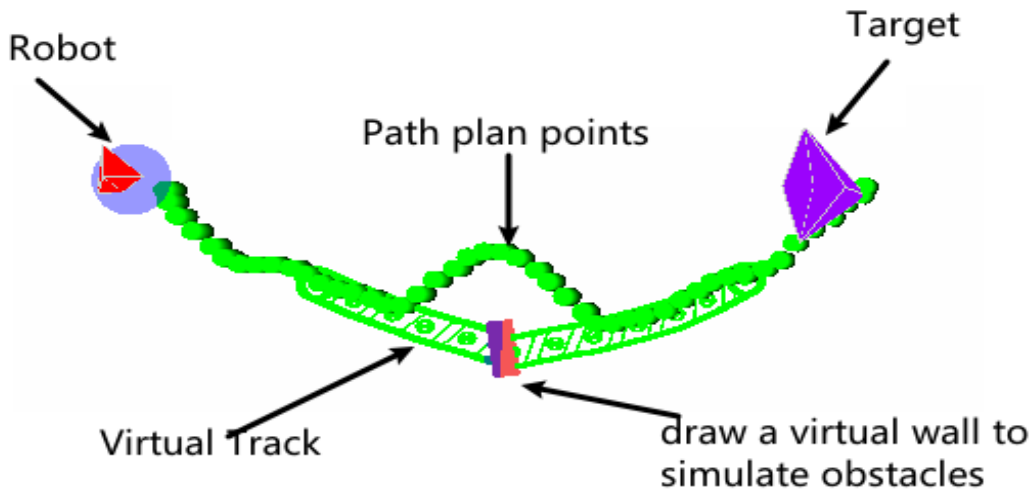


Figure 2.7.9 Path finding in virtual track aided navigation mode

Generate Track Via Click

Click **Virtual Track -> Draw Line By Click** in the toolbar of the menu bar. When clicked, the track generation method changes to selecting a starting and ending points on the map, which is convenient for scenarios where drawing lines by dragging is difficult due to large map sizes.

During this process, the circular markers indicate the starting and ending points as shown in figure 2.8.0.

Figure 2.8.0 Generate track via click

Display Track Direction

Click **Virtual Track -> Show Track Arrow** in the toolbar of the menu bar. This function is used to display the direction of tracks in figure 2.8.1.

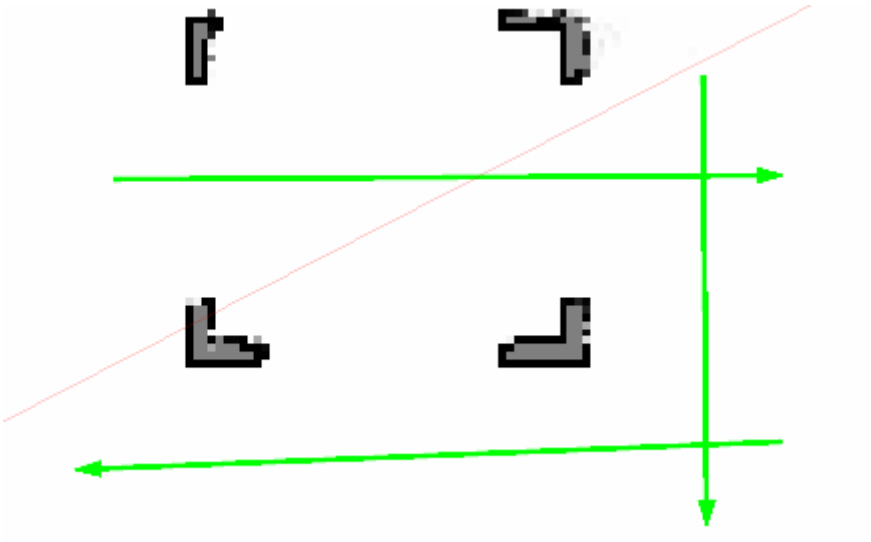


Figure 2.8.1 Display Track Direction

During this mode, adding or selecting a track will display an arrow indicating the current direction of the track in figure 2.8.2.

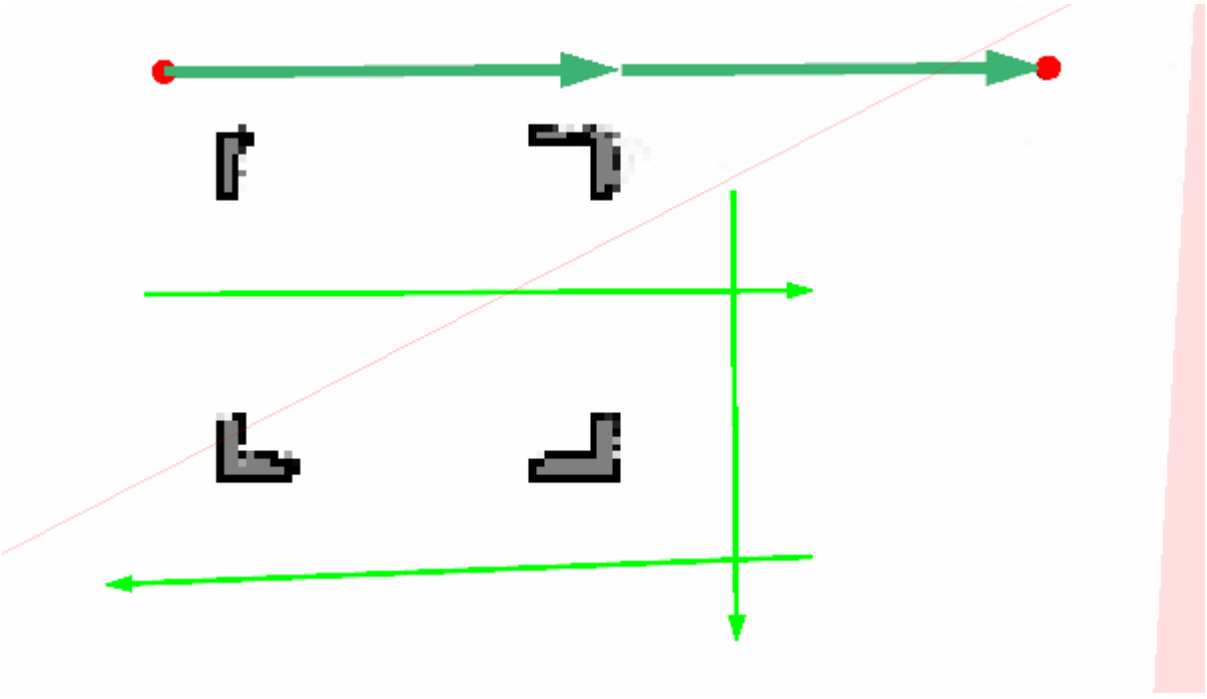


Figure 2.8.2 adding or selecting a track display the track direction

Reverse Track

Click **Virtual Track -> Select Track -> Reverse Track** in the toolbar of the menu bar. This function allows the user to amend the track direction when incorrectly positioned in figure 2.8.3.

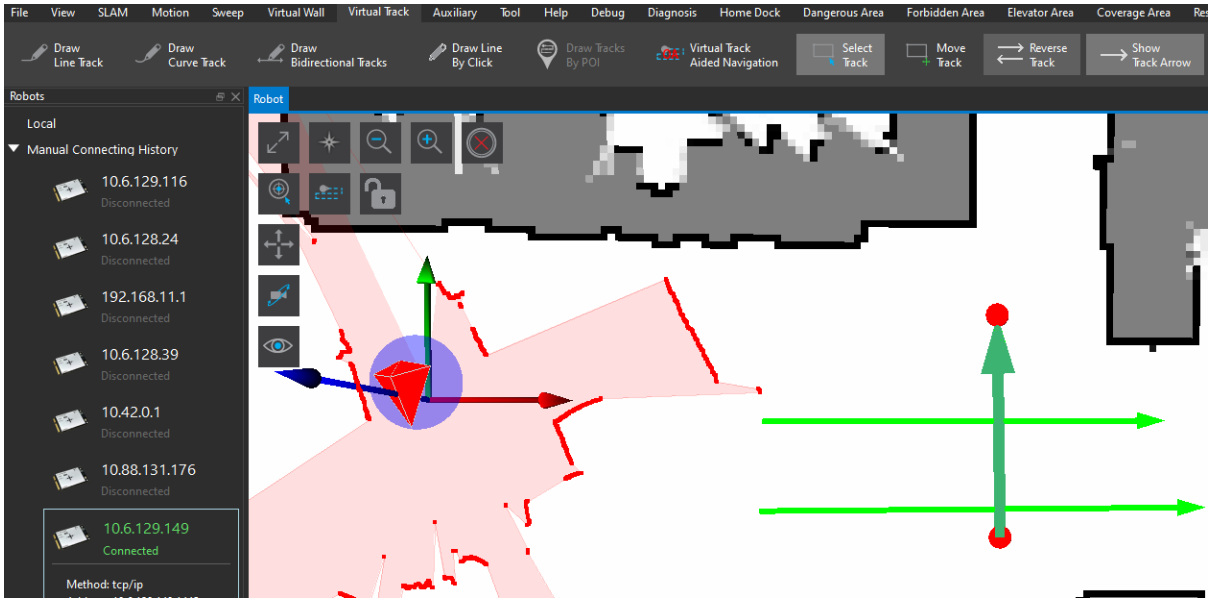


Figure 2.8.3 reverse track direction

POI(point of interest) Management

With POI management feature, users can save the map coordinates they are interested in to the POI list and later move the robot to one of the above coordinates by directly choosing it in the list. To have this feature, the POI plugin needs to be installed in the RoboStudio first.

Open POI List

Click **Tool**->**POI** in the menu bar, and the dock window **POIs** pops up in the left side of the workspace as shown in Figure 2.8.1. Users can create, edit, move or delete POIs in this window and make the robot move to a POI in the map by clicking the POI in the coordinate list of this window.

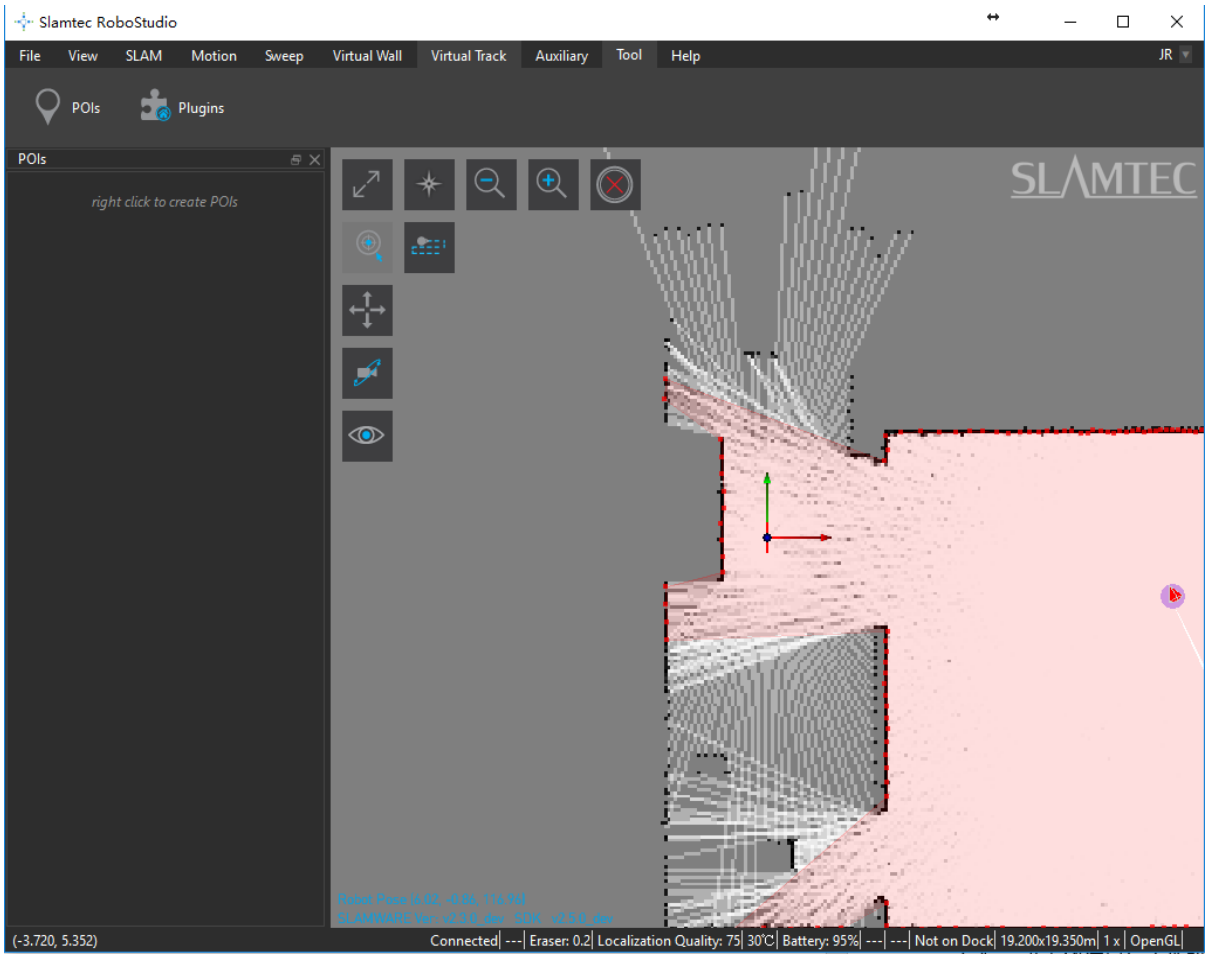


Figure 2.8.1 POI Management List

Create POIs

Right-click the white space in the **POIs** list, and click **Create POI** in the pop-up window as shown in Figure 2.8.2 to enter "POI creating mode"(*the cursor in the map turns into an up arrow*). Left-click a point in the map to open the **POI Info** dialog box as shown in Figure 2.8.3.

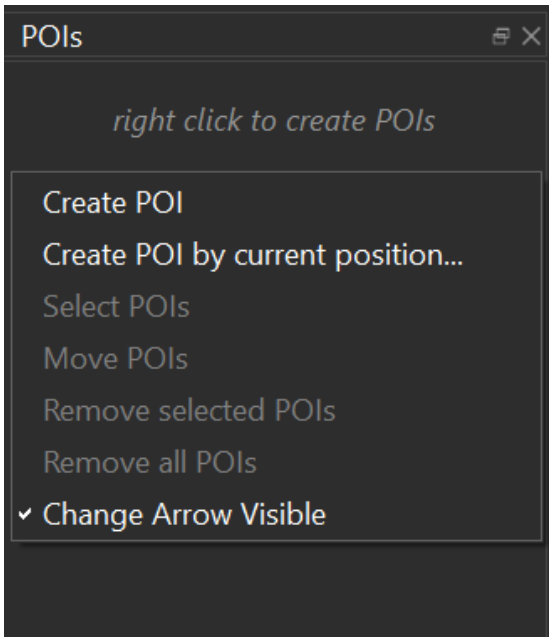


Figure 2.8.2 Right-click Menu In The White Space Of POIs list

In the following **POI Info** dialog box, users can edit the POI name, modify the value on X/Y axes and Yaw to adjust the POI position. After clicking **OK**, the POI is created successfully and is listed in the **POIs** window as shown in Figure 2.8.1.

Note: the **Display Name** of POI may be repeatable but the **POI ID** is unique.

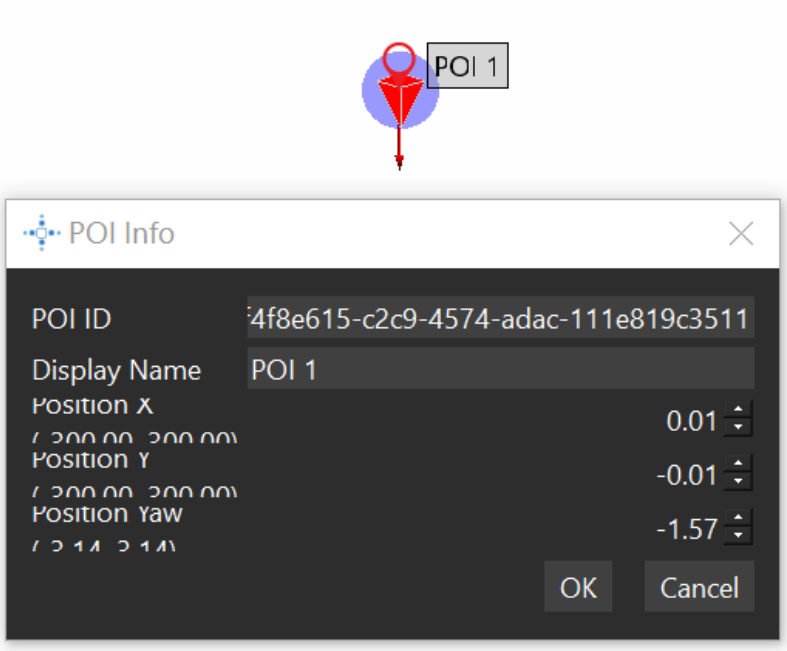


Figure 2.8.3 POI Info Dialog Box

In addition, users can create POI for the current position of the robot. Right-click the white space in the **POIs** list, and click **Create POI by current position** in the

context menu to open the **POI Info** dialog box. Edit information in the same way and click **OK** to create a POI for the current position of the robot.

Edit POIs

Right-click a POI in the list of the **POIs** window and choose **Edit** in the context menu to open the **POI Info** dialog box. Edit the POI name and coordinates and yaw in the box.

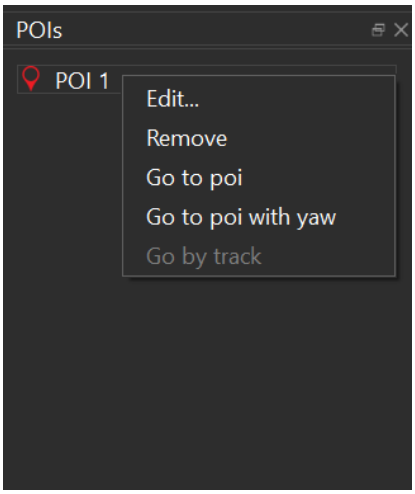


Figure 2.8.4 Right-click Menu In POIs

Choose POIs

Right-click the white space in the **POIs** list and click **Select POIs** in the context menu to enter POI selection mode(*the cursor in the map turns into an cross*) . Left-click and drag a box to select POIs in the map or directly click a POI in the **POIs** list to select or cancel it.

Note: when a POI is selected, the POI icon in the **POIs** list and in the map turn from red to green.

Exit POI selection mode:

1. Right-click the white space in the **POIs** list and click **Select POIs** in the context menu to exit POI selection mode.
2. Right-click in the map of the working space.

Move POIs

For the selected POIs, right-click the white space in the **POIs** list and click **Move POIs** in the context menu to enter POI move mode(*the cursor in the map turns into an moving cross*). Left-click and drag a POI to move it to a different place.

Exit POI move mode:

1. Right-click the white space in the **POIs** list and click **Select POIs** in the context menu to exit POI select and move mode.
2. Right-click the white space in the **POIs** list and click **Move POIs** in the context menu to exit POI move mode.
3. Right-click in the map of the working space.

Delete POIs

Remove selected POIs: for the selected POIs, right-click the white space in the **POIs** list and click **Remove selected POIs** in the context menu.

Remove all POIs: right-click the white space in the **POIs** list and click **Remove all POIs** in the context menu.

Remove single POI: right-click a POI in the **POIs** list and click **Remove POI** in the context menu to remove this POI from the map.

Navigation Via POIs

1. Double-click a POI in the **POIs** list, and the robot moves to the chosen POI in the map.

Note: key combination with **Shift** key or **Ctrl** key is supported. For details, please refer to **Move Robot** chapter.

2. Right-click the white space in the **POIs** list and click **Go to POI** in the context menu.
3. Right-click the white space in the **POIs** list and click **Go by track** in the context menu.
4. Right-click the white space in the **POIs** list and click **Go to poi with yaw** in the context menu.

Add POIS to queue

Users can add POI to queue using the following steps

1. In the toolbar click **POI**, then click **Select POI**.
2. Right-click mouse and drag over a POI point and you will see the POI point turn green in figure 2.8.5.

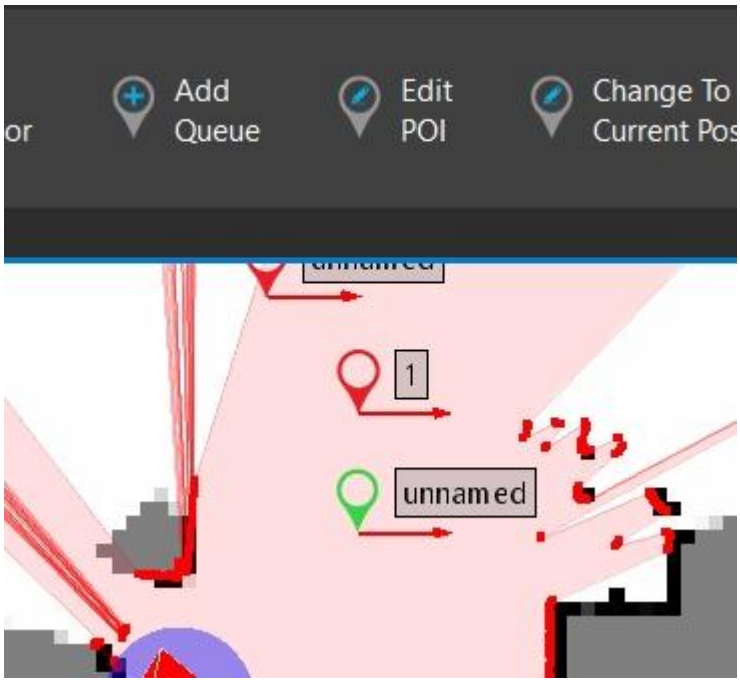


Figure 2.8.5 POIs point turn green when selected

3. Click **Add Queue** in the toolbar. On the map, left-click the position where you want to add the queue point and the **POI Info** dialog box will appear (as shown in Figure 2.8.6).

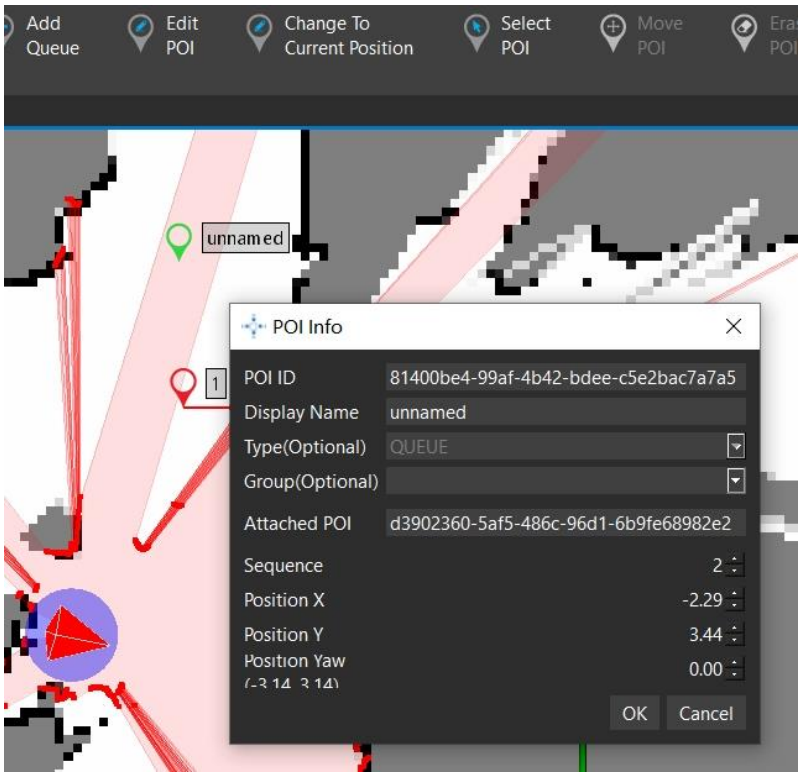


Figure 2.8.6 Adding Queue Point

4. Modify the **Display Name** and the **Sequence**. Sequence with the smaller value has the higher priority (1 has highest priority).

5. Click the "**OK**" button to add the POI to queue.

Plugin Manager

RoboStudio provides rich plugin resources for users to choose and apply in different application scenarios.

The usage permission for plugin is bound with user account, so user can use the plugin both in online mode and offline mode.

Click **Tool->Plugin** in the menu bar to open **Plugin Manager** dialog box as shown in Figure 2.9.1. User can check the current loading plugins, run or stop a plugin and go to plugin store to get new plugins.

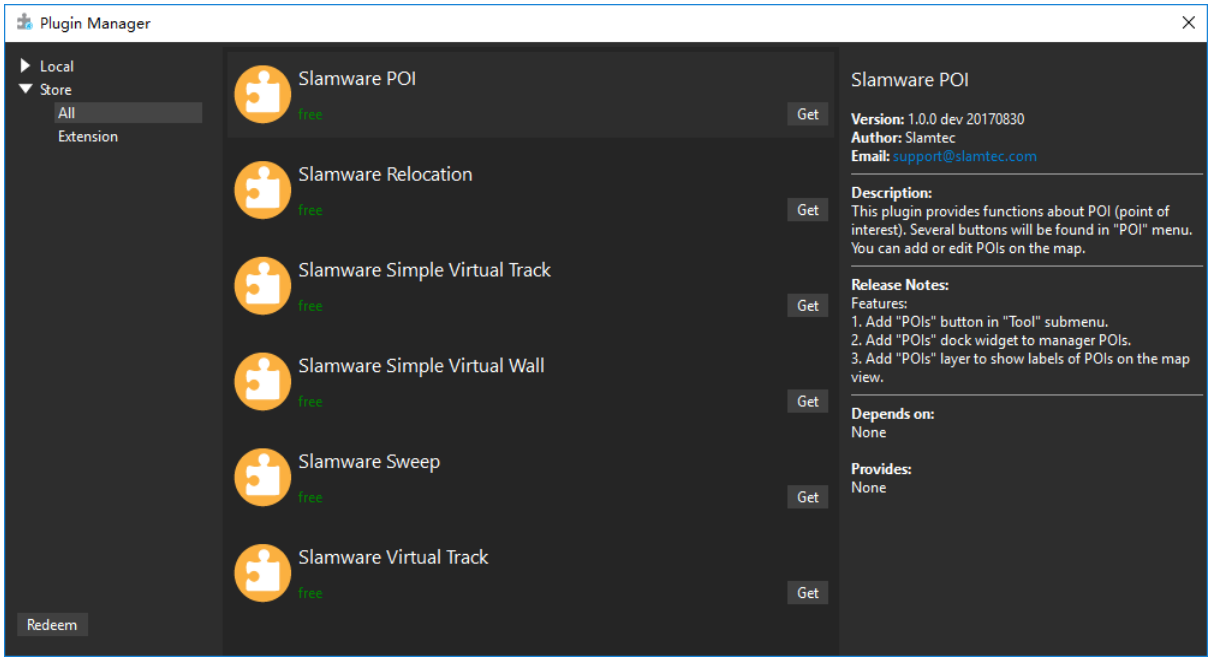


Figure 2.9.1 Plugin Manager Dialog Box

Plugin Store

Click **Store->All** in the left panel of **Plugin Manager** dialog box to get the available plugin list. Click a plugin and check its version, author, content introduction, dependency and other information in the right column.

Get/purchase plugins: there is a **Get** button in the right side of unauthorized plugins for users to click and get the plugins.

Download plugins: for the newly obtained plugin, there is a **Download** button in the right side for users to download it to the local computer.

Local Plugin

Click **Local**->**All** in the left panel of **Plugin Manager** dialog to get the local plugin list as shown in Figure 2.9.2. Click a plugin and check its version, author, content introduction, dependency and other information in the right column.

Run/Stop a plugin: the plugins are loaded automatically after the RoboStudio launching. And for those loaded plugins, there is **Run** or **Stop** in the right side for users to switch the status of the plugins. Once a plugin is stopped, its related function and layer service are stop.

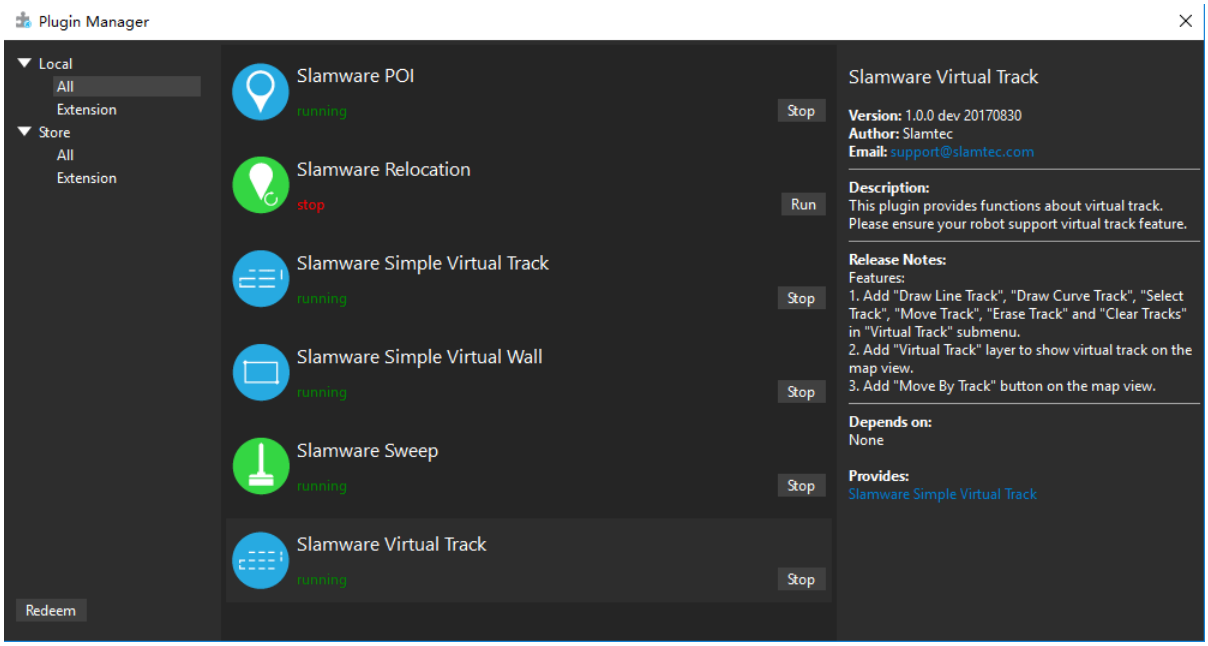


Figure 2.9.2 Local Plugin Management

Redeem Plugin

Users can get a SLAMTEC internal trial plugin with a redeem code. Click **Redeem** in the left bottom corner of **Plugin Manager** dialog box and enter a redeem code in the opened **Plugin Redeem** dialog as shown in Figure 2.9.3. Once redeeming successfully, users can find the plugin in the store and download it.

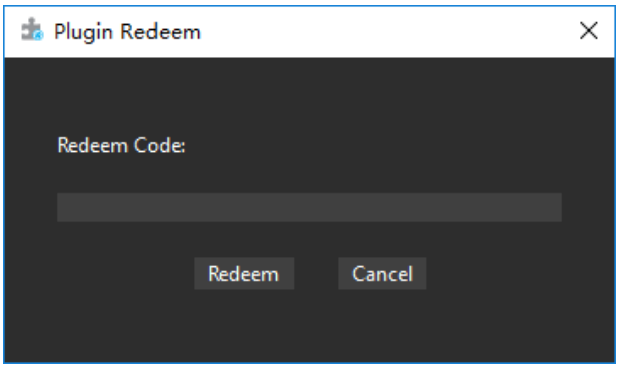


Figure 2.9.3 Plugin Redeem Dialog

Slamware Config Tool

After launching onlineslam, the robot will load all the configuration files and merge them as a real time configuration information, and the robot depends on this configuration information for the later mapping and path planning process. Once the onlineslam process finished, the merged configuration information does not exist anymore.

Users can use the **Slamware Config Tool** plugin in RoboStudio to load, edit and save the configuration information of the robot.

Click **File**-> **Slamware Config Tool** in the menu bar to open **Slamware Config Tool** dialog box as shown in Figure 2.10.1.

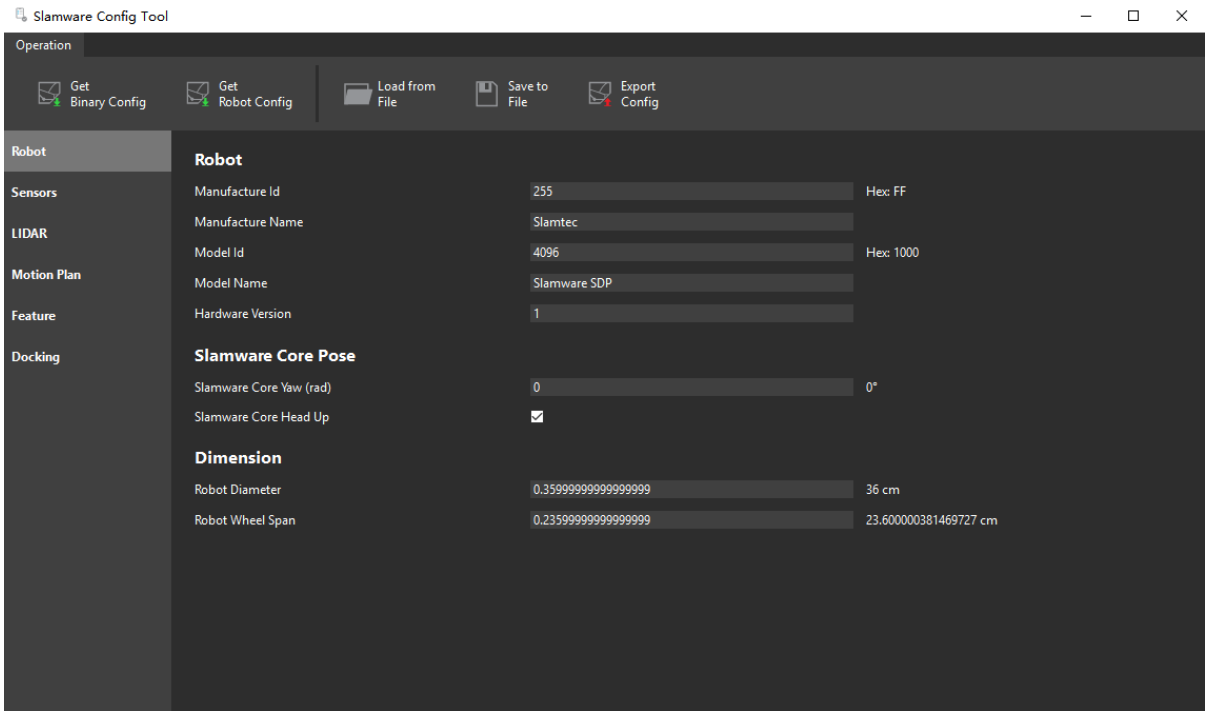


Figure 2.10.1 Slamware Config Tool Dialog

Load Configuration Information

1. Get Binary Config

While the RoboStudio is connected with the robot, click **Get Binary Config** in the **Slamware Config Tool** dialog box to get the binary configuration file for loading and then updating the transformed information in the dialog box.

2. Get Robot Config (onlineslam version is 2.3 or above)

While the RoboStudio is connected with the robot, click **Get Robot Config** in the **Slamware Config Tool** dialog box to get the real time robot configuration information and update it in the dialog box.

3. Get local file configuration

Click **Load from File** in the **Slamware Config Tool** dialog box to load robot configuration file from the local device and update it in the dialog box.

Edit Configuration Information

As shown in Figure 2.10.1 the loaded information are about robot, sensors, LIDAR, motion plan, feature and docking. Click the specific category to modify related configuration options.

Note: the real time configuration of the robot will not be affected by editing the configuration options in the **Slamware Config Tool** dialog box.

Save Configuration Information

Slamware Config Tool supports to save the configuration information in the following format:

1. Text format(.slconf)

Click **Save to File** in the **Slamware Config Tool** dialog box->choose a proper location for saving the file and edit the file name in the pop-up dialog box->click **Save**.

2. Binary config format(.c and .c.bin)

Click **Export Config** in the **Slamware Config Tool** dialog box->choose a proper location for saving the file and edit the file name in the pop-up dialog box->click **Save**.

SlamCube Config Tool

The Cube Configuration Tool is used to view, edit, export, and upload Cube configurations to the robot. Compared to the SlamWare Configuration Tool, the Cube Configuration Tool offers more configuration options and allows for configuring various aspects related to the Cube.

In the toolbar menu click **File -> SlamCube Config Tool** a dialog box will appear in Figure 2.10.2

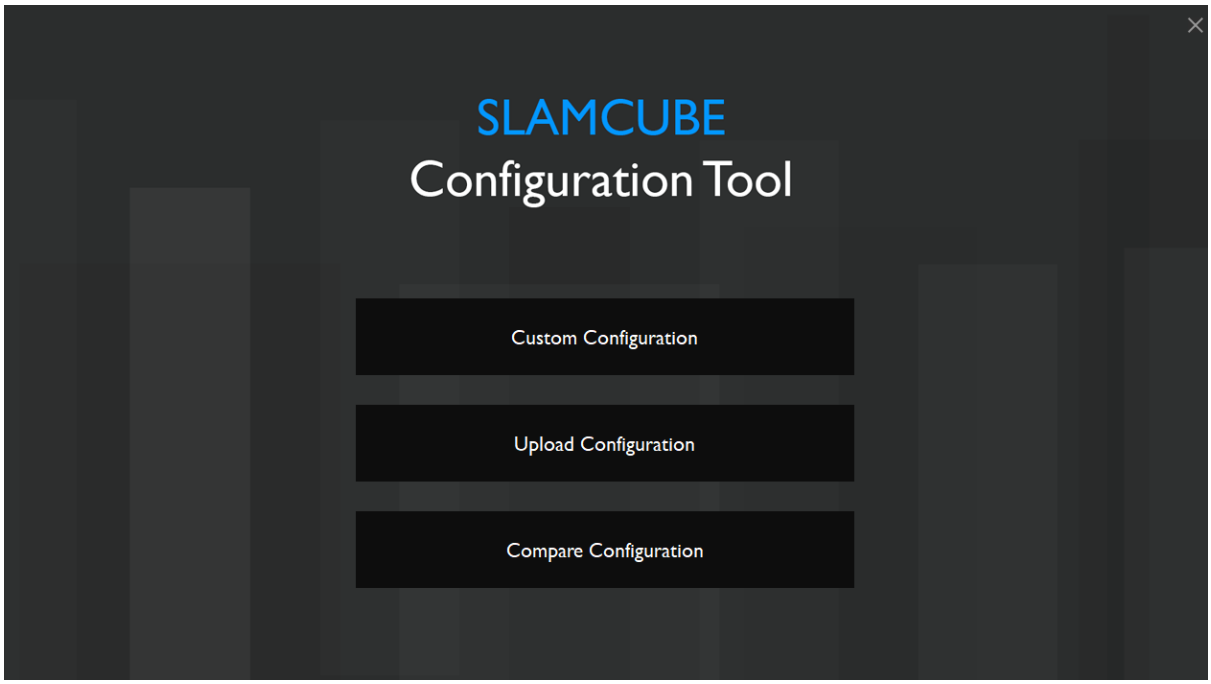


Figure 2.10.2 SlamCube Config Tool Dialog

Custom Configuration

Click on **Custom Configuration -> Connect Device and Load**. Enter the robot's **IP address** and click **Confirm**, a new interface will appear in Figure 2.10.3

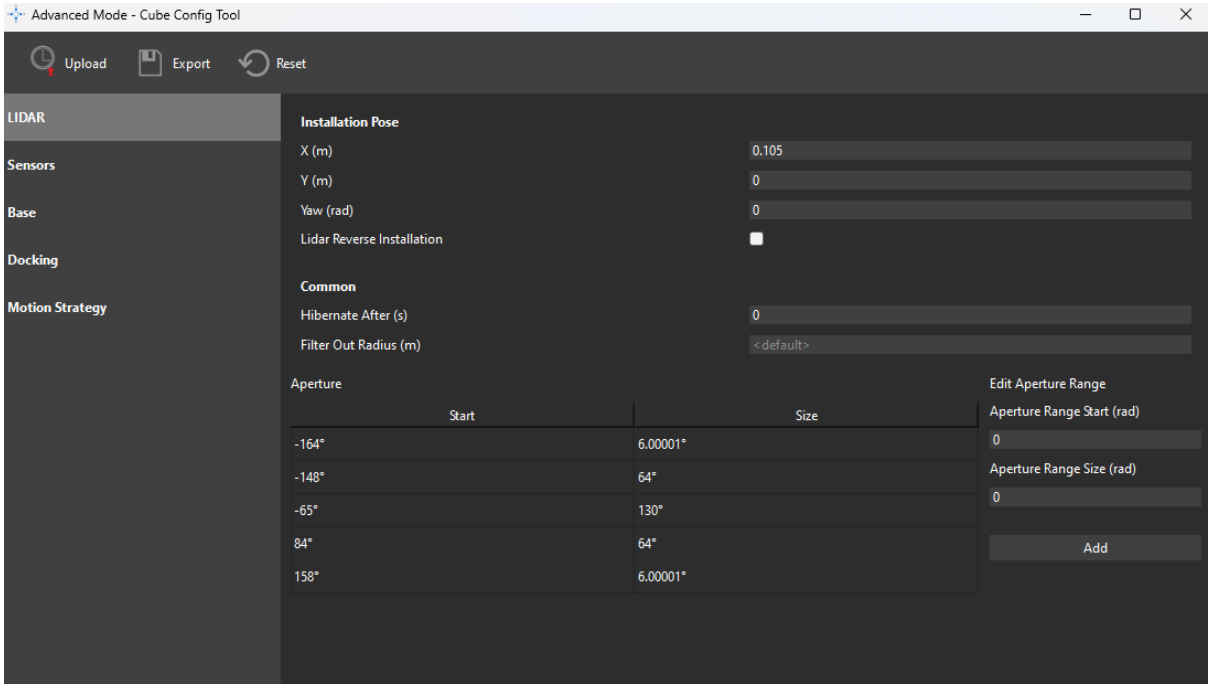


Figure 2.10.3 SlamCube Custom Configuration

There are 5 tabs in the context menu: LIDAR, Sensors, Base, Docking, and Motion Strategy. In the Sensors tab, you can edit directly by double-clicking onto the cell in the table in Figure 2.10.4.

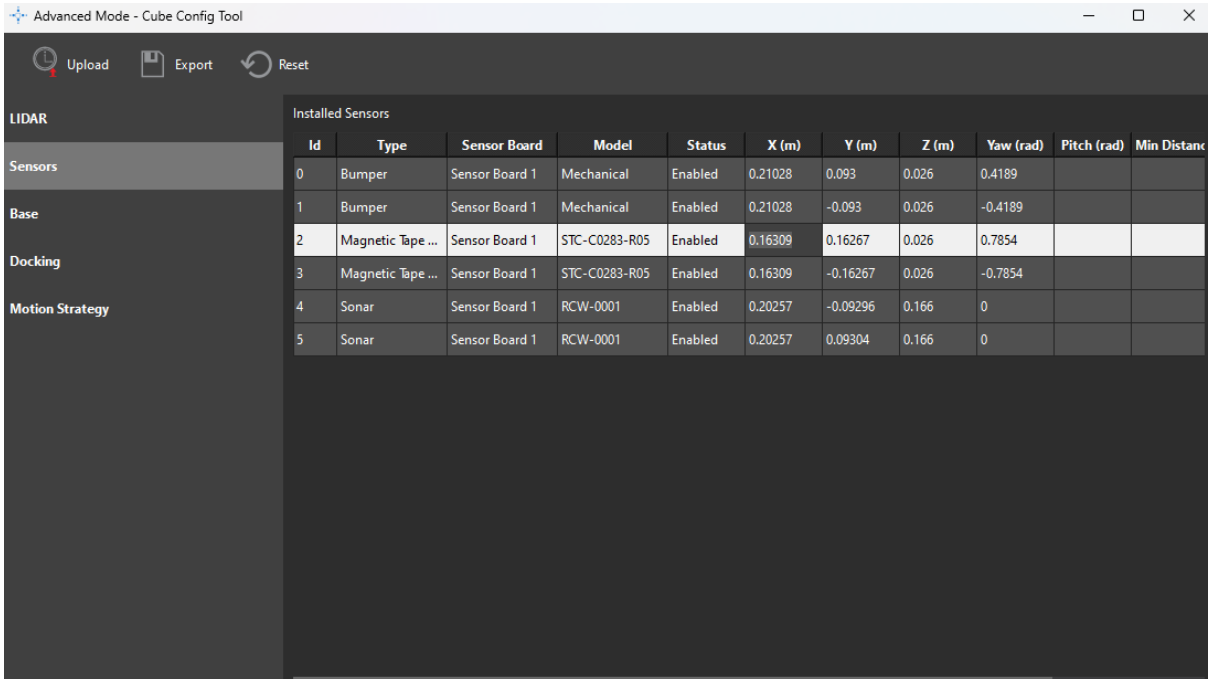
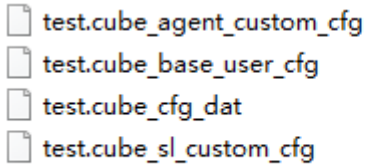


Figure 2.10.4 Edit cell value in Sensors tab

Right-click the cell to perform operations such as add, delete, move up, and move down. After completing the editing, click **Upload** to upload the configuration to the robot. Click **Export** to export the configuration to a file, which will generate the following four files:



Upload Configuration

In addition to editing online and then uploading, you can directly select a file to upload to the robot. In the initial interface, click **Upload Configuration**. Then click **Config File**, select a cube_cfg_dat file, enter the robot's IP, and click **Upload Config**.

Figure 2.10.5 upload configuration

Compare Configuration

The **Compare Configuration** can be used to compare configuration differences between two files, two machines, or one machine and one file.

Figure 2.10.6 Compare Configuration

Configuration value with differences will be highlighted in red in Figure 2.10.7.

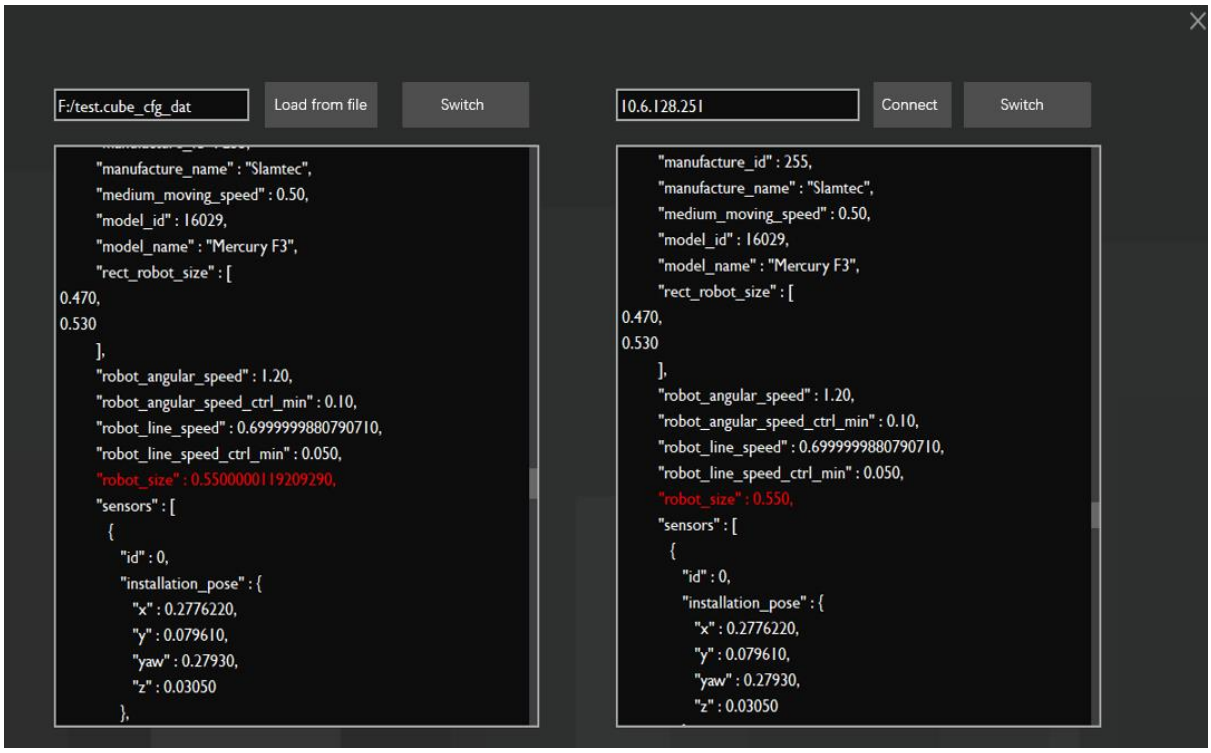


Figure 2.10.7 Compare Configuration with different result

Sensor Map Plugin

Robot merges sensor data including lidar, bumper, sonar and etc. in real time as the reference during later mapping and path planning process. And users also need to evaluate the performance of some sensor in the above process.

The sensor map plugin facilitates the performance evaluation for sensors. It provides independent map layer for following sensors:

1. Lidar
2. Wall-following sensor
3. Bumper sensor
4. Depth camera
5. Sonar
6. Door sensor

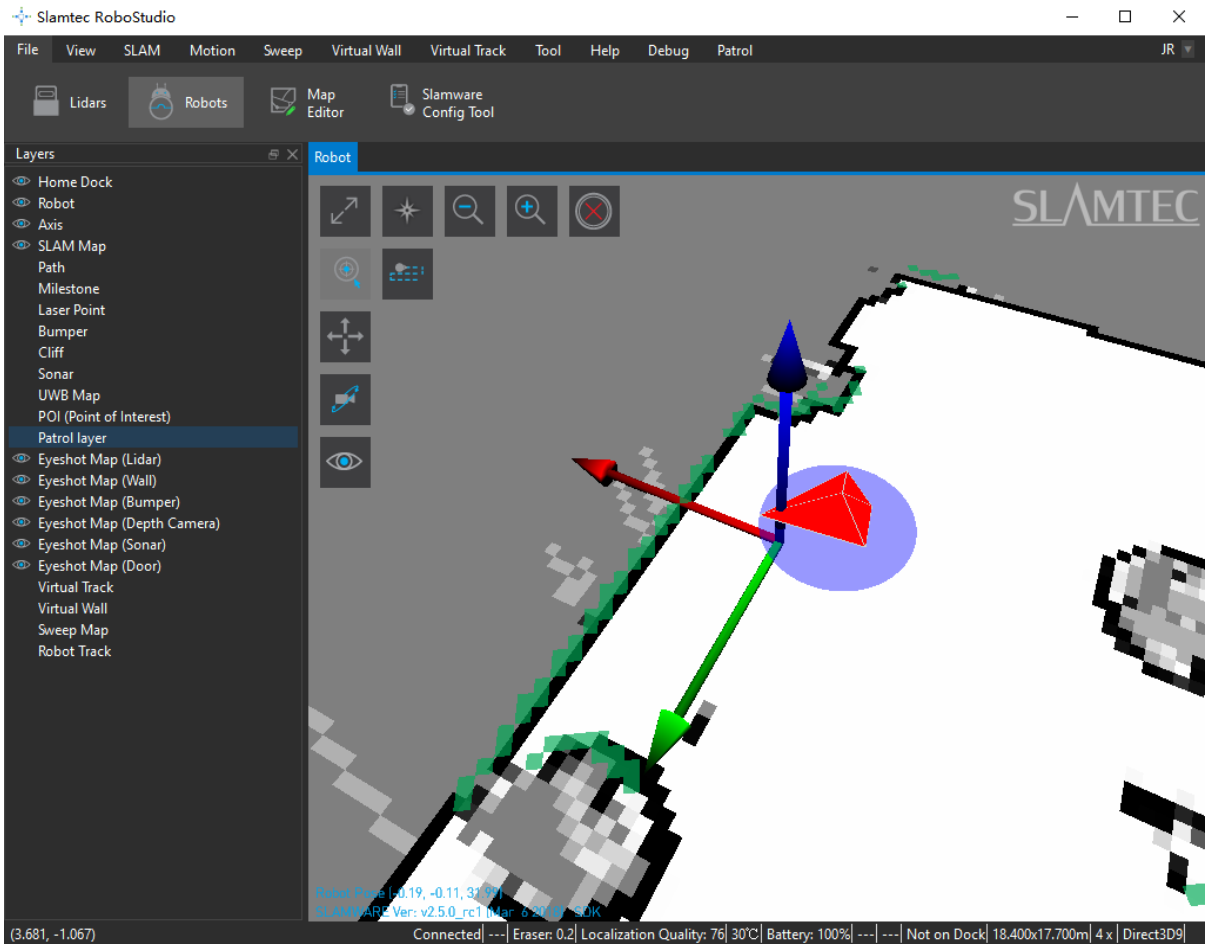


Figure 2.11.1 Slamware Config Tool Dialog

Please note that the independent sensor map layer will not display automatically after loading the sensor map plugin. As shown in Figure 2.11.1, if users want to observe the map of some sensor, they can click the display button (the eye icon) on the upper left corner of the map, and the docked **Layers** window will pop up in the left side of the working area. Choose a sensor map and it will display in grid in the map.

Forbidden Area Management

In the warehouse storage environment, in order to avoid the robot touching the shelf, the virtual wall is set as the boundary protection. However, there is a defect in this kind of protection. That is when the robot is carrying goods, it may be pushed in or pushed by other robots for some reason. The existing virtual wall rules will make it unable to judge whether the robot is in the free zone or the restricted zone, so it can not reach the original task target. In order to avoid this kind of problem, we provides the function of forbidden area, so that the robot can judge whether it is in the restricted area by itself, and then can escape from the forbidden area. In addition to the storage environment, this function is also suitable for protecting glass display cabinets, staircases and other areas.

The forbidden area means that the more dangerous the area is to the center. Thus, it is mainly composed of two parts: the escape area and the core area. When the robot is in the escape area, it will try to plan a path far away from the core area to escape the forbidden area. If the robot enters the core area, it will stop moving.

The toolbar of Forbidden Area

The **Forbidden Area** tool bar as shown in the Figure 2.12.1 will appear when RoboStudio with the Forbidden Area plug-in installed connects to the robot supports the Forbidden Area function.

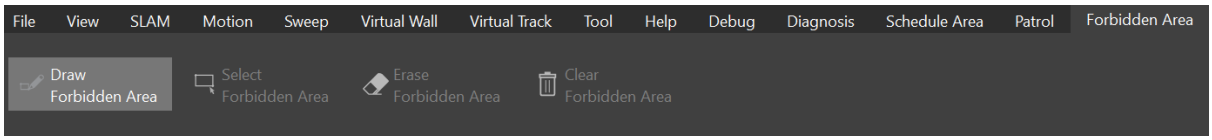


Figure 2.12.1 The toolbar of Forbidden Area

Draw Forbidden Area

Click **Forbidden Area – Draw Forbidden Area** in the menu toolbar. After lighting up that, click and drag, and there will be a green line when dragging on the map. After releasing the mouse, a pop-up window will appear, as shown in Figure 2.12.2.

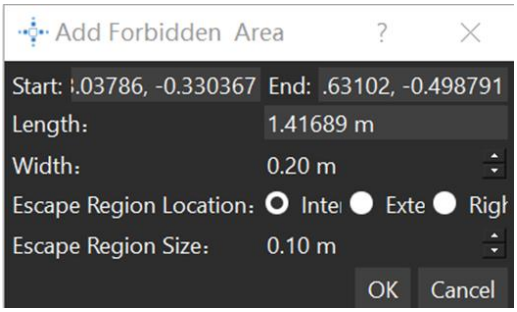


Figure 2.12.2 Add Forbidden Area Dialog

1) Descrption of each button in the Add Forbidden Area Dialog

Start: The location of the cursor on the map when the user clicks.

End: The location of the cursor on the map when the user releases the mouse.

Length: The distance between the start points and end points.

Width: The width of the exterior forbidden area or interior forbidden area.

Escape Region Location: For details, please refer to 2) .

Escape Region Size: The distance between the interior forbidden area and the boundary of the forbidden area, as shown in Figure 2.12.3.

OK: Confirm to add the forbidden area.

Cancel: Cancel adding the forbidden area.

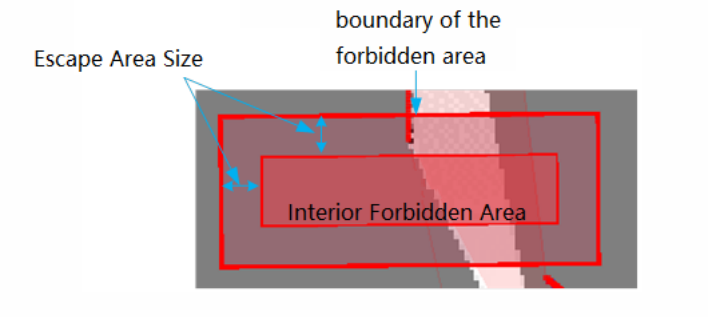


Figure 2.12.3 Escape Region Size

2) Description of Escape Region Location

There are three modes of setting escape area location when adding forbidden area, which are "Interior", "Exterior" and "Right".

For better explanation, some symbols are defined as below.

Content	Symbol
The length of the boundary of the forbidden area	ExteriorLength
The width of the boundary of the forbidden area	ExteriorWidth
The length of the interior forbidden area	InteriorLength
The width of the interior forbidden area	InteriorWidth
Escape Region Size	EscapeDist
The **Length** set in the Add Forbidden Area dialog	Length
The **Width** set in the Add Forbidden Area dialog	Width

a)Interior

In this mode, the center of the interior forbidden area and the whole forbidden area is the center of the line added by the user, as shown in Figure 2.12.4. Moreover, the length and width of the interior forbidden area and forbidden area are as follows.

$$\begin{aligned} ExteriorLength &= Length \\ ExteriorWidth &= Width \\ InteriorLength &= Length - 2 * EscapeDist \\ InteriorWidth &= Width - 2 * EscapeDist \end{aligned}$$

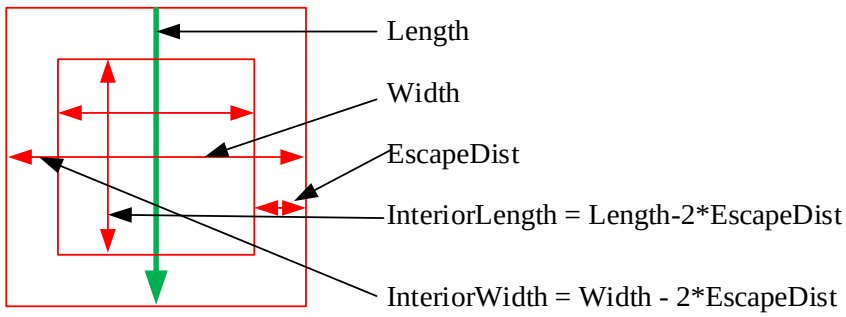


Figure 2.12.4 Set up forbidden area inward

b)Exterior

In this mode, the center of the inner forbidden area and the whole forbidden area is the center of the line added by the user, as shown in Figure 2.12.5. Moreover, the length and width of the internal forbidden area and forbidden area are as follows.

$$\begin{aligned} ExteriorLength &= Length + 2 * EscapeDist \\ ExteriorWidth &= Width + 2 * EscapeDist \\ InteriorLength &= Length \\ InteriorWidth &= Width \end{aligned}$$

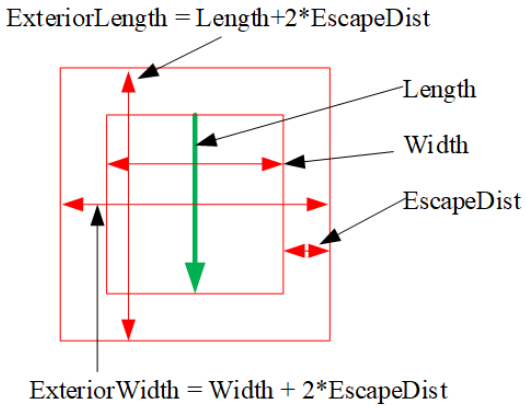


Figure 2.12.5 Set up forbidden area outward

c)Right

In this mode, from the starting point to the end point, the forbidden area is on the right, and the relationship between the interior forbidden area and the whole forbidden area is shown in Figure 2.12.6. Moreover, the length and width of the interior forbidden area and forbidden area are shown below.

$$ExteriorLength = Length$$
$$ExteriorWidth = Width$$
$$InteriorLength = Length - 2 * EscapeDist$$
$$InteriorWidth = Width - 2 * EscapeDist$$

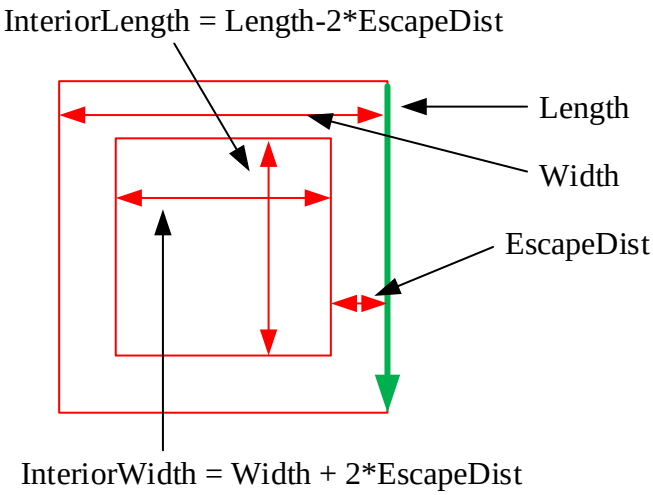


Figure 2.12.6 Set up forbidden area towards the right

Select Forbidden Area

Click **Forbidden Area –Select Forbidden Area** in the top menu toolbar, and the mouse will turn into a black cross. Left-click and drag the mouse to frame the whole forbidden, and the selected forbidden area will change from red to purple.

Erase Forbidden Area

After selecting the forbidden area, click **Forbidden Area – Erase Forbidden Area** to delete the selected forbidden area.

Clear Forbidden Area

In the menu toolbar area, click **Forbidden Area – Clear Forbidden Area** to delete all the forbidden areas in the current map.

FrameGrabber

RoboStudio provides FrameGrabber plugin for evaluating and testing lidars. User can observe the lidar's real time scanning result and save it to the local device for further analysis.

Before launching FrameGrabber, please ensure that the lidar module has already been connected to computer via USB and the required driver has already been installed on the computer.

Lidars List

Click **File**->**Lidars** in the menu bar to open the **Lidars** docked window on the left side of major working area as shown in Figure 2.13.1.

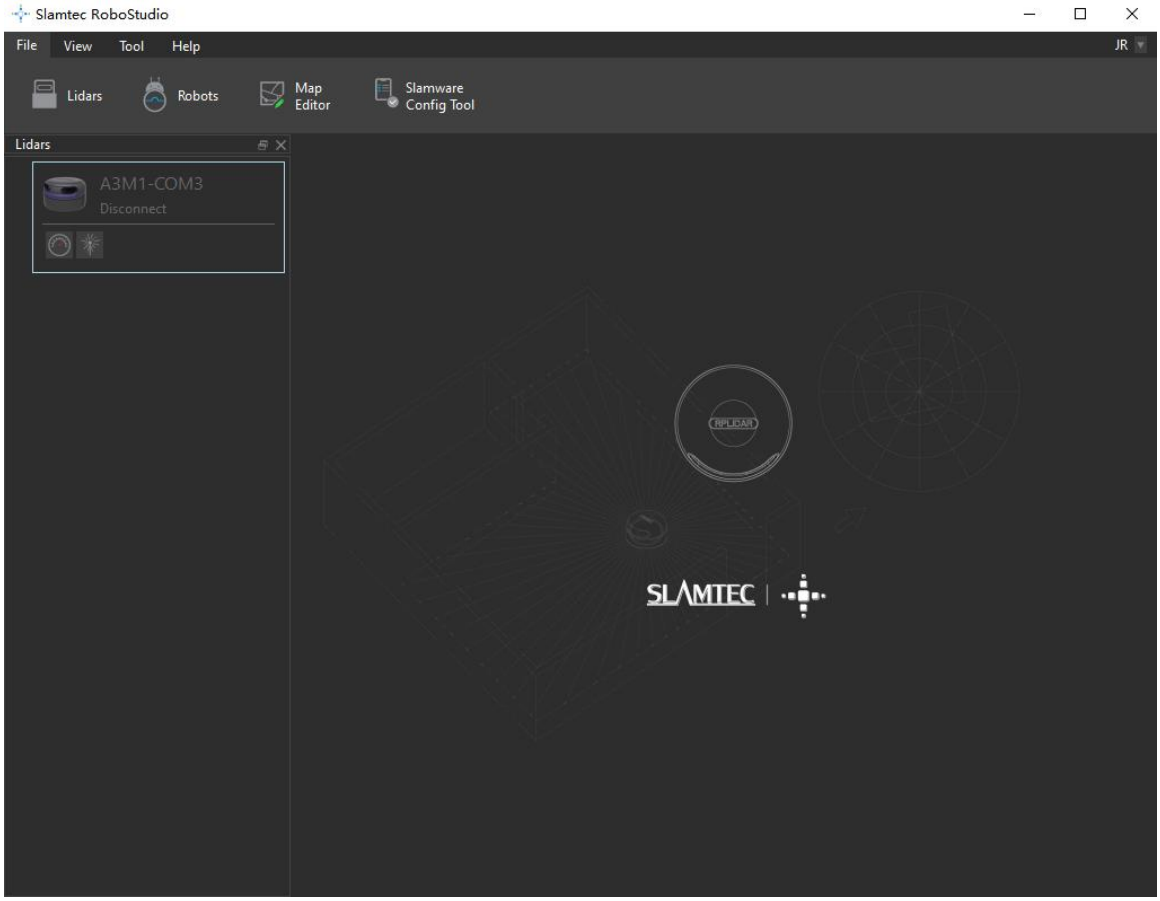


Figure 2.13.1 Lidars Management Panel

Connection

FrameGrabber plugin supports lidar connection via serial port, USB and TCP server.

1. Autonomous Discovery

FrameGrabber plugin supports to discover and recognize lidars connected via serial port automatically and display them in the **Lidars** docked window. Users can double click the lidar to connect it or start scan directly.

2. Manual Connection

Right click the black space in the **Lidars** list and choose **Manual Connect Lidar** in the context menu to open the **Select Communication Port** dialog box as shown in Figure 2.13.2. Choose the corresponding port in the drop-down menu to connect to the lidar.

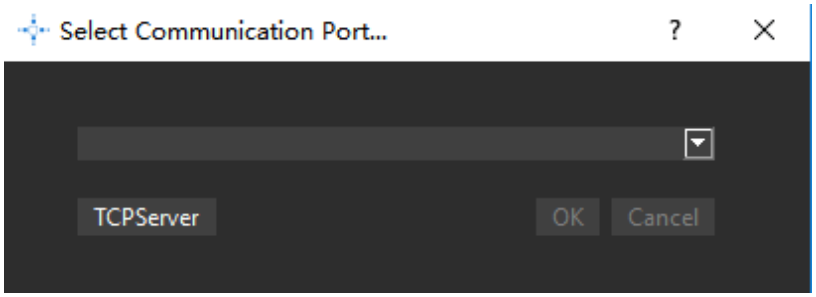


Figure 2.13.2 Manually Select Port for Lidars Connection

Users can also click **TCPServer** button to open the **TCPServer** dialog box as shown in Figure 2.13.3 and enter the corresponding IP address and port name to connect to the lidar.

Connected lidars will be listed in the lidar list of the **Lidars** docked window.

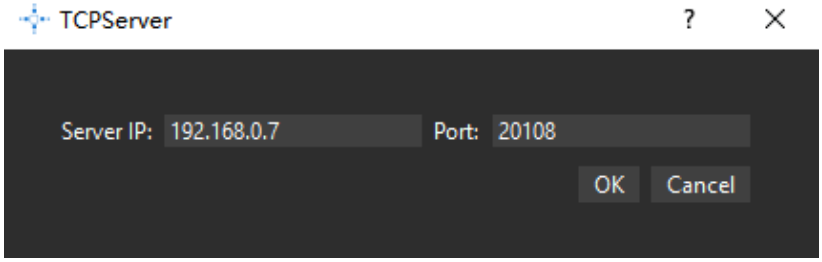


Figure 2.13.3 TCP Server for Lidars Connection

Scan Mode Selection

Users can select a scan mode before starting scanning. As shown in Figure 2.13.4, right click the lidar listed in the **Lidars** docked window and choose a scan mode in the context menu.

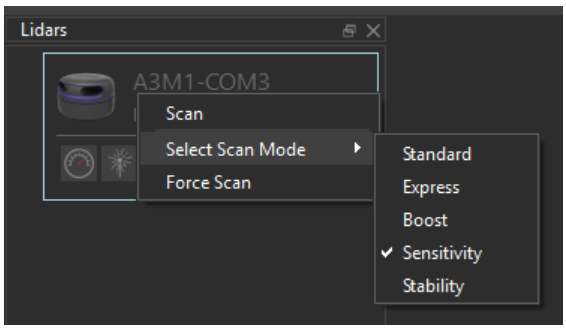


Figure 2.13.4 Scan Mode Selection

Start Scan

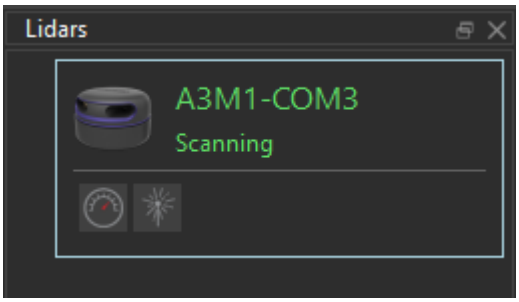


Figure 2.13.5 Lidars Panel

As shown in Figure 2.13.4, right click the lidar listed in the **Lidars** docked window and choose **Scan** in the context menu to start scanning. After launching successfully, the lidar name turns to green and its status switches to **Scanning** as shown in Figure 2.13.5.

Motor Speed Adjustment

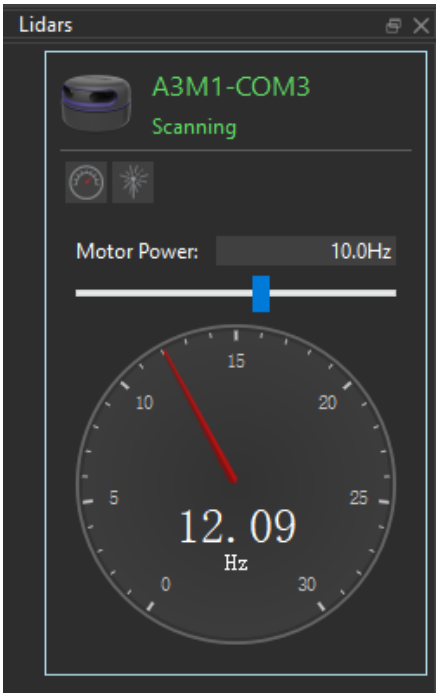


Figure 2.13.6 Motor Speed Adjustment Dash Board

During the scanning process, click the  (the button to set the lidar motor rotating speed) button below the lidar to open the rotating speed control panel as shown in Figure 2.13.6. Users can enter required rotating speed in the speed adjustment dialog box or drag the sliding handle to the required rotating speed. The lidar's real time rotating speed is displayed in the dash board.

Start Observation

Double click the lidar window or click the  (the button to display the scanning result) button below the lidar to open the scanning observation window as shown in Figure 2.13.7.

The tool bar is on the top left side of the observation area while the lidar serial number is on the top right side. Please check Figure 2.13.8 for detailed functions for the buttons in the tool bar.

The real time rotating speed of the lidar is displayed under the tool bar and the scan mode (4K, 8K, 16K) is displayed under the serial number. The real time scanning status of the lidar is displayed as a polar coordinates system in the center part of the window.

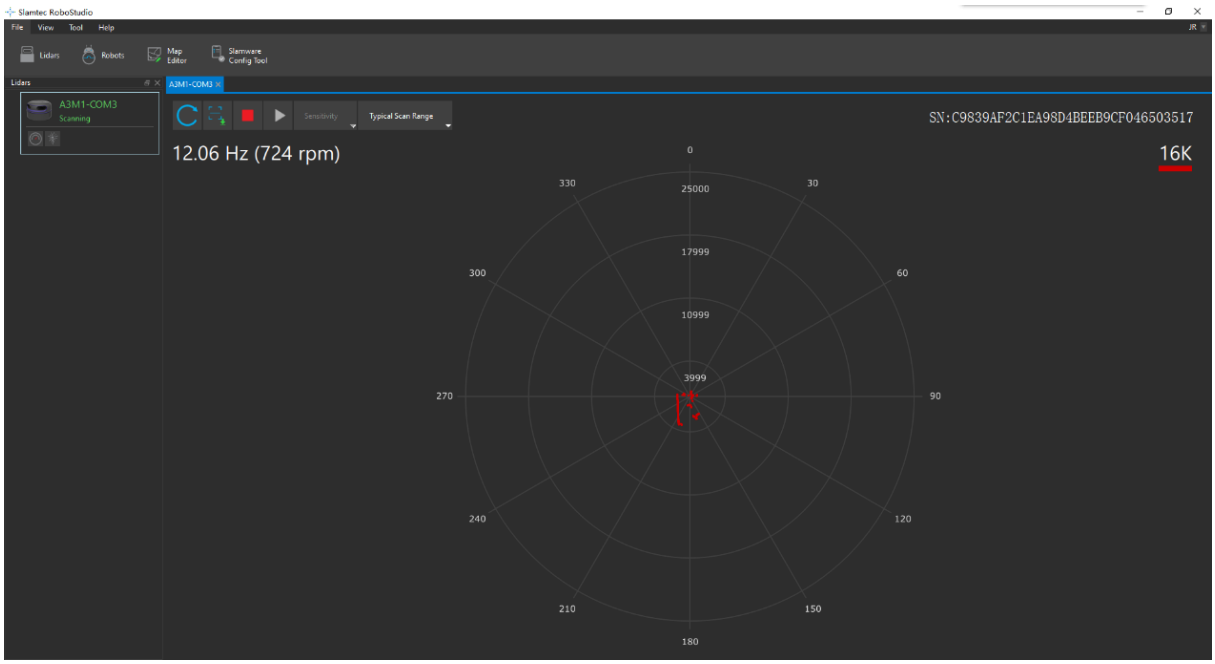


Figure 2.13.7 Scan Observation Window

Button	Fucntion	Description
	Restart RPLIDAR	Restart scan core to clear internal errors
	Save scan data	Save current scan data to the local file
	Stop scan	Scan core enter power save mode

▶	Start scan	Scan data will be displayed after scan core starting work stably
Sensitivity	Switch working mode	Switch among different work modes to fit in specific environments
Typical Scan Range	Switch to typical scan range	Adjust the motor speed as required

Figure 2.13.8 The Buttons in The Tool Bar on the Top of the Observation Window

Figure 2.13.9 is the lidar observation window. Right click in the observation area to open the context menu and users can switch among different displaying range, reset the scan center, show or hide laser beam. In addition, the display result can also be changed according to the following shortcuts:

1. Scroll up or down with the mouse to increase or decrease the range;
2. Scroll up or down with the mouse while pressing the **Ctrl** key to increase or decrease the range quickly;
3. Hold the left mouse button and drag in the observation area to translate the polar coordinates;
4. Double click in the observation area to reset the polar coordinates.

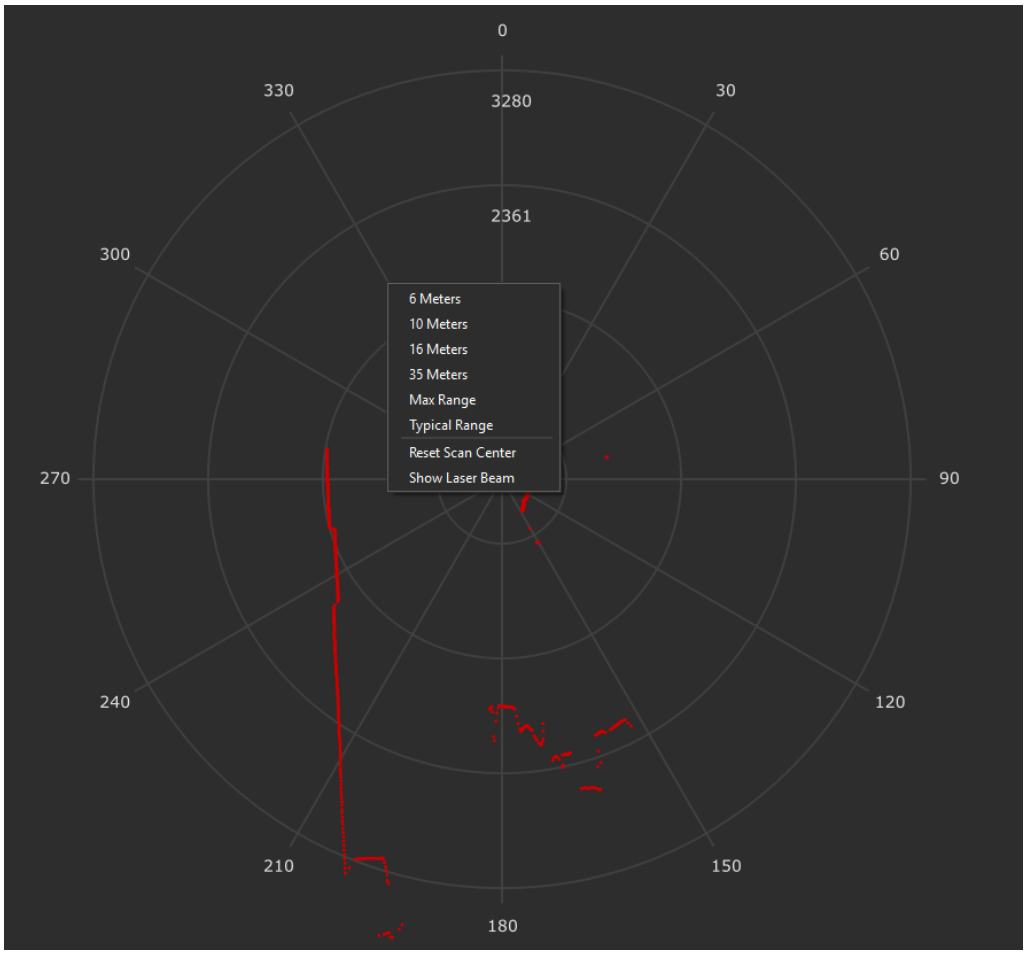


Figure 2.13.9 Context Menu in Scan Mode

Stop Scan

Lidar scanning can be stopped by the following methods:

1. Click the **Stop** button (red square button) on the top of the observation window.
2. As shown in Figure 2.13.10, right click the lidar in the **Lidars** panel and choose **Stop** in the context menu.

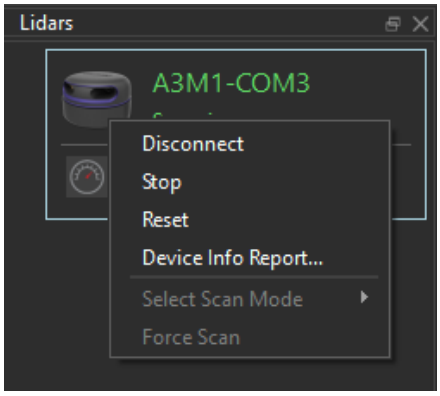


Figure 2.13.10 Context Menu in Scan Mode

Disconnection

As shown in Figure 2.13.10, right click a lidar in the **Lidars** panel and choose **Disconnect** in the context menu to disconnect from the lidar.

Map Editor

Figure for Map Editor

Operating procedure

When the map editor is opened, it defaults to displaying the current map of the robot. You can click **Load from File** to choose and load an .stcm file. **Save to File** allows you to save the current data as a map file, which can be saved as an stcm file or a bmp image (only preserving the explorer map and losing information such as virtual walls). Clicking **Upload to Slamware** to set the map to the currently connected robot.

Location

Drag the robot icon to change the robot's pose, and drag the cross star icon to change the map's origin. Click **Upload Robot Pose** to set the new pose to the robot.

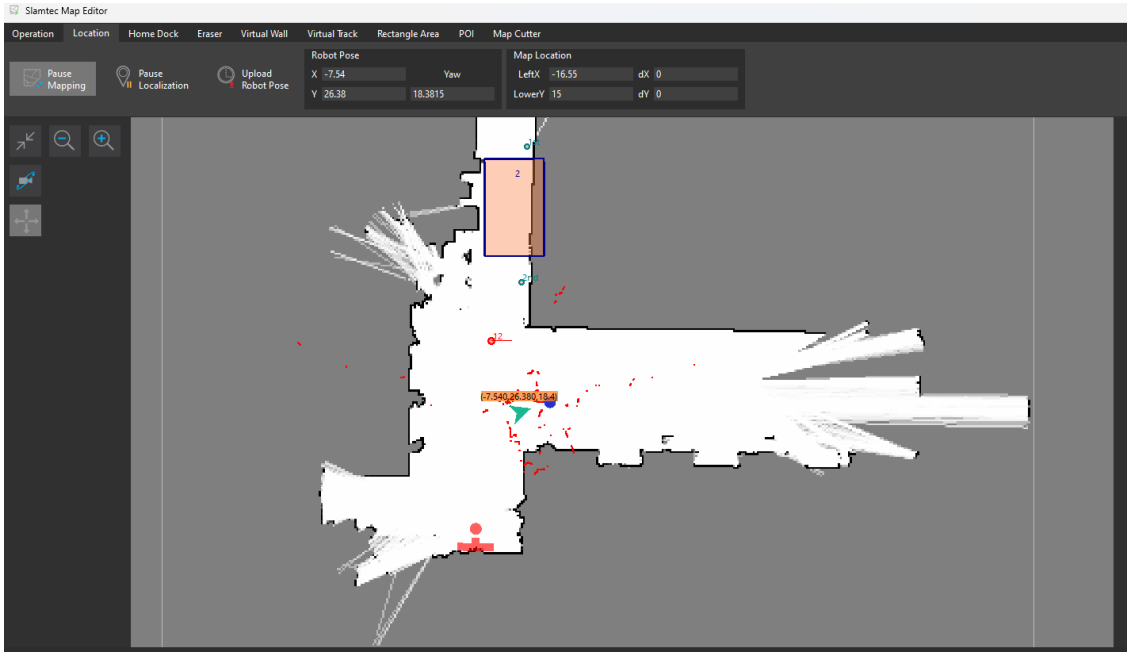


Figure for Set Robot Pose and Map Position

Home Dock

Drag the **dock** icon to modify the pose of the charging pile. Click **Add HomeDock** to add a new charging pile. A map can contain multiple charging piles. (This feature is supported in firmware version 4.3.5 and higher.)

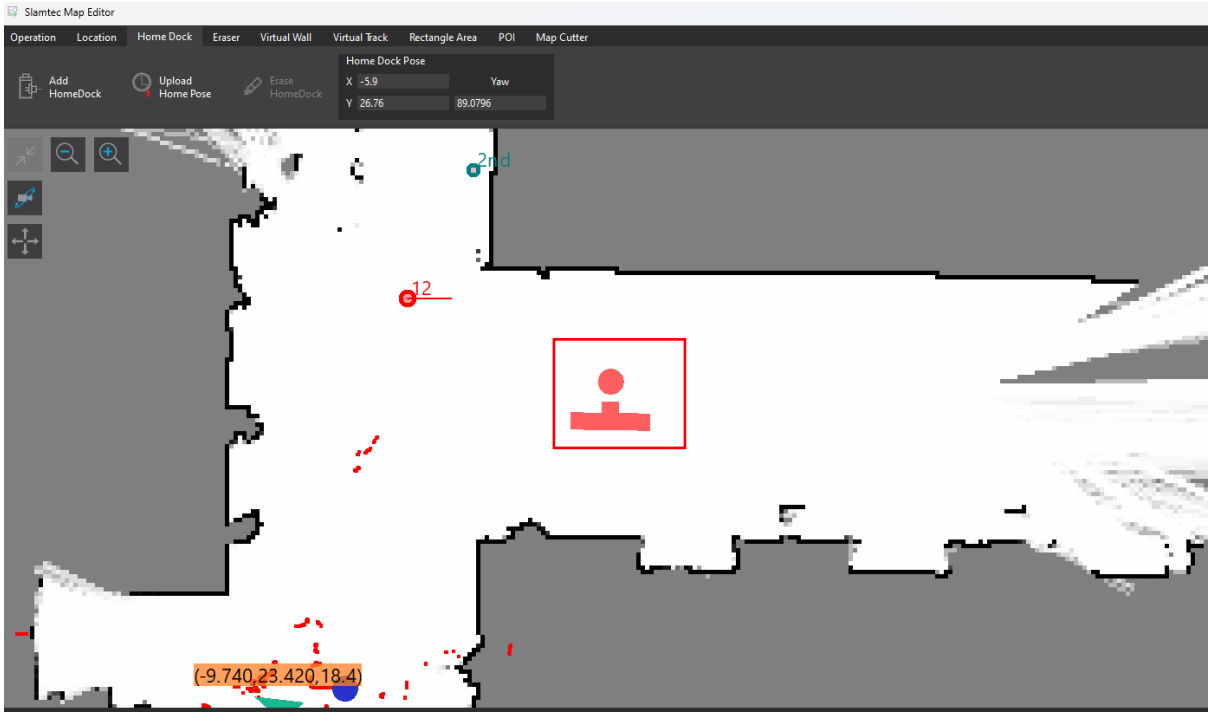


Figure for Home dock management

Eraser

The eraser has three colors: black, gray, and white. Black represents obstacles, gray represents unknown areas, and white represents discover areas. The cursor size of

the eraser is fixed. By zooming in/out the map with the mouse wheel, you can adjust the size of the eraser. As shown in the two figures below, zooming out the map is equivalent to enlarging the eraser size, and zooming in the map is equivalent to reducing the eraser size. Zooming in the map by six times allows for the modification of a single grid.

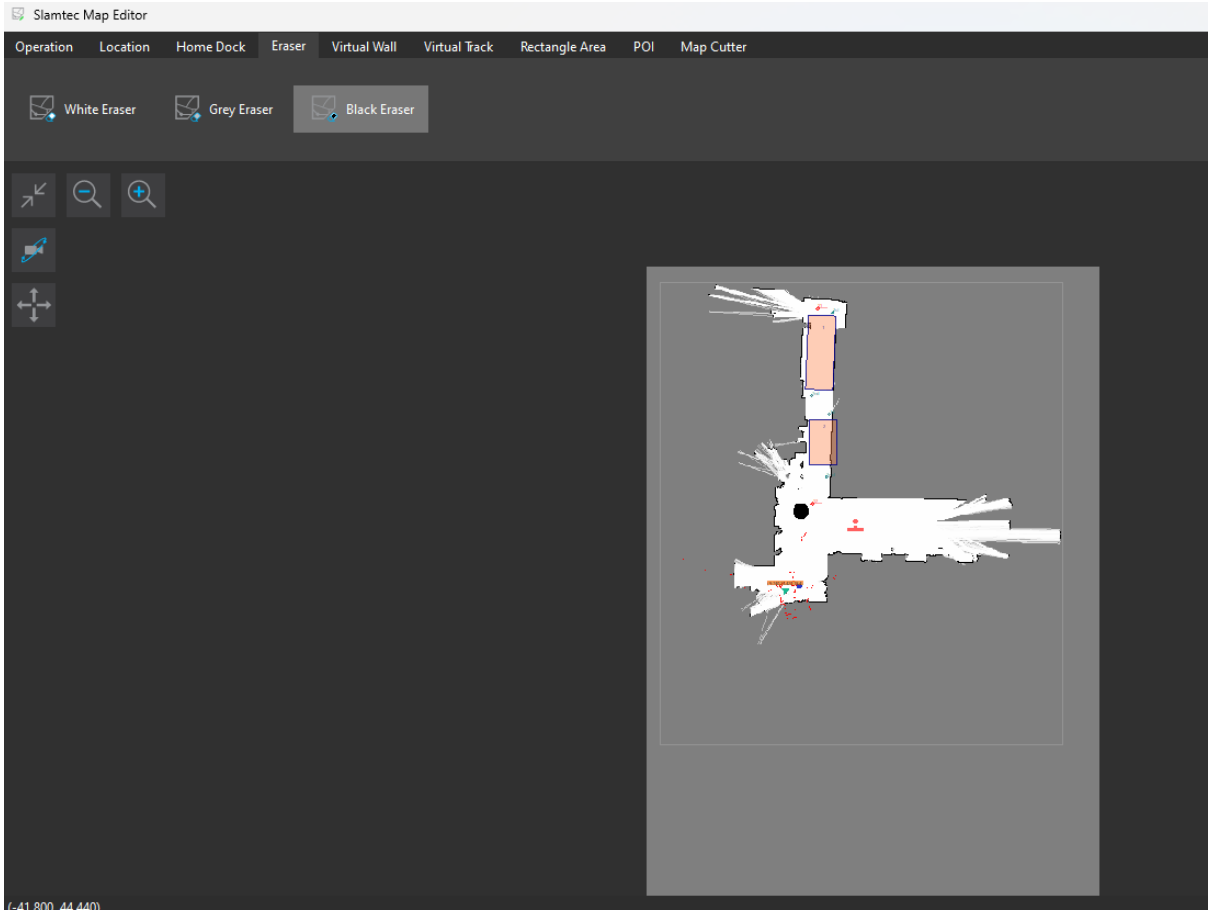


Figure for Enlarge size eraser

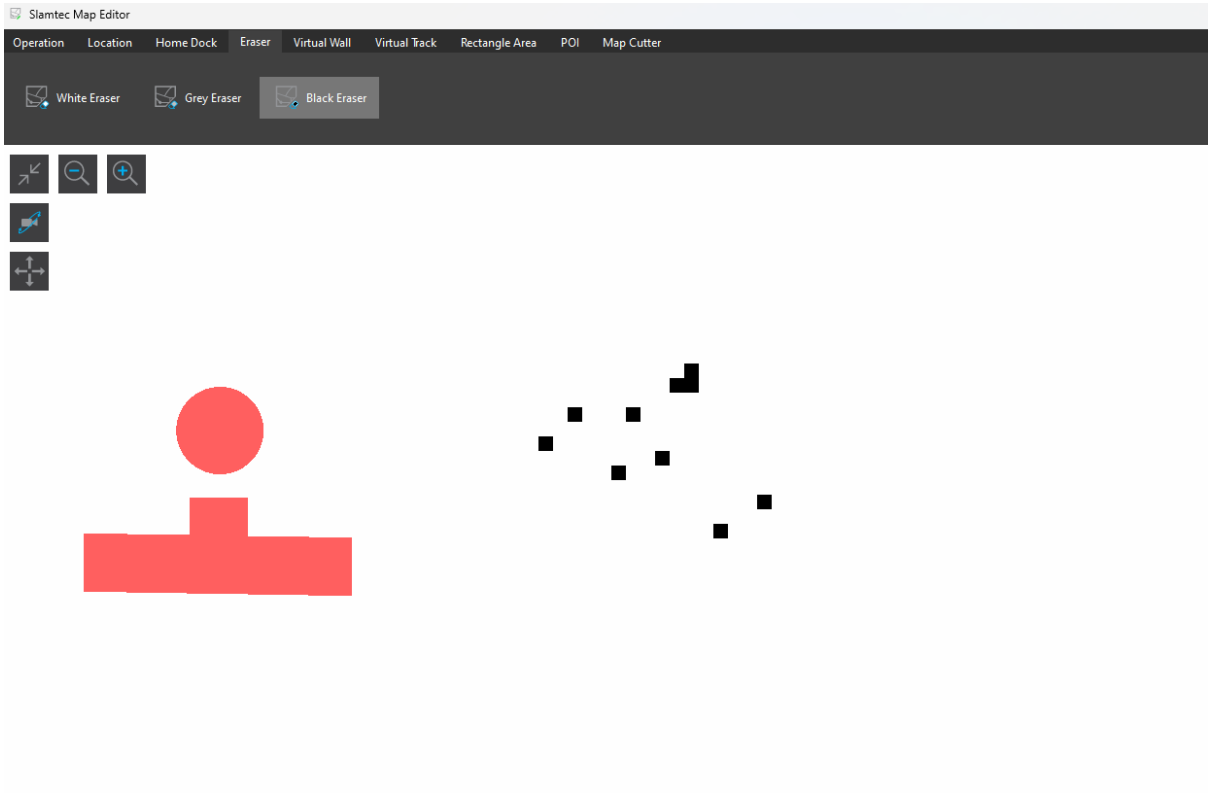


Figure for Shrink size eraser

Virtual Wall

The functionality is the same as the virtual wall management in the main interface. The difference is that modifications in the main interface are directly applied to the robot, while modifications in the map editor are only retained in the memory of RoboStudio. They need to be **Uploaded to Slamware** to take effect or saved to an stcm file.

Virtual Track

The functionality is the same as the virtual track management in the main interface. The difference is that modifications in the main interface are directly applied to the robot, while modifications in the map editor are only retained in the memory of RoboStudio. They need to be **Uploaded to Slamware** to take effect or saved to an stcm file.

Rectangle Area

Rectangular areas are manually marked areas on the map. The currently supported rectangular areas are:

•Maintenance Area: Only updates the map that is inside this area, anything outside the area will not be updated.

• Forbidden Area: Prohibits the robot from entering. If the robot mistakenly enters or is pushed into this area, it can automatically escape.

• Sensor disabled Area: Disabled the robot's sensor.

•Elevator Area: Marks the elevator location, a necessary element for multi-floor maps.

• Dangerous Area: Used to limit the robot's maximum movement speed.

• Coverage Area: Used to cover planned areas.

• Restricted Area: Used for multi-robot scheduling, limiting the number of robots that can simultaneously enter this area.

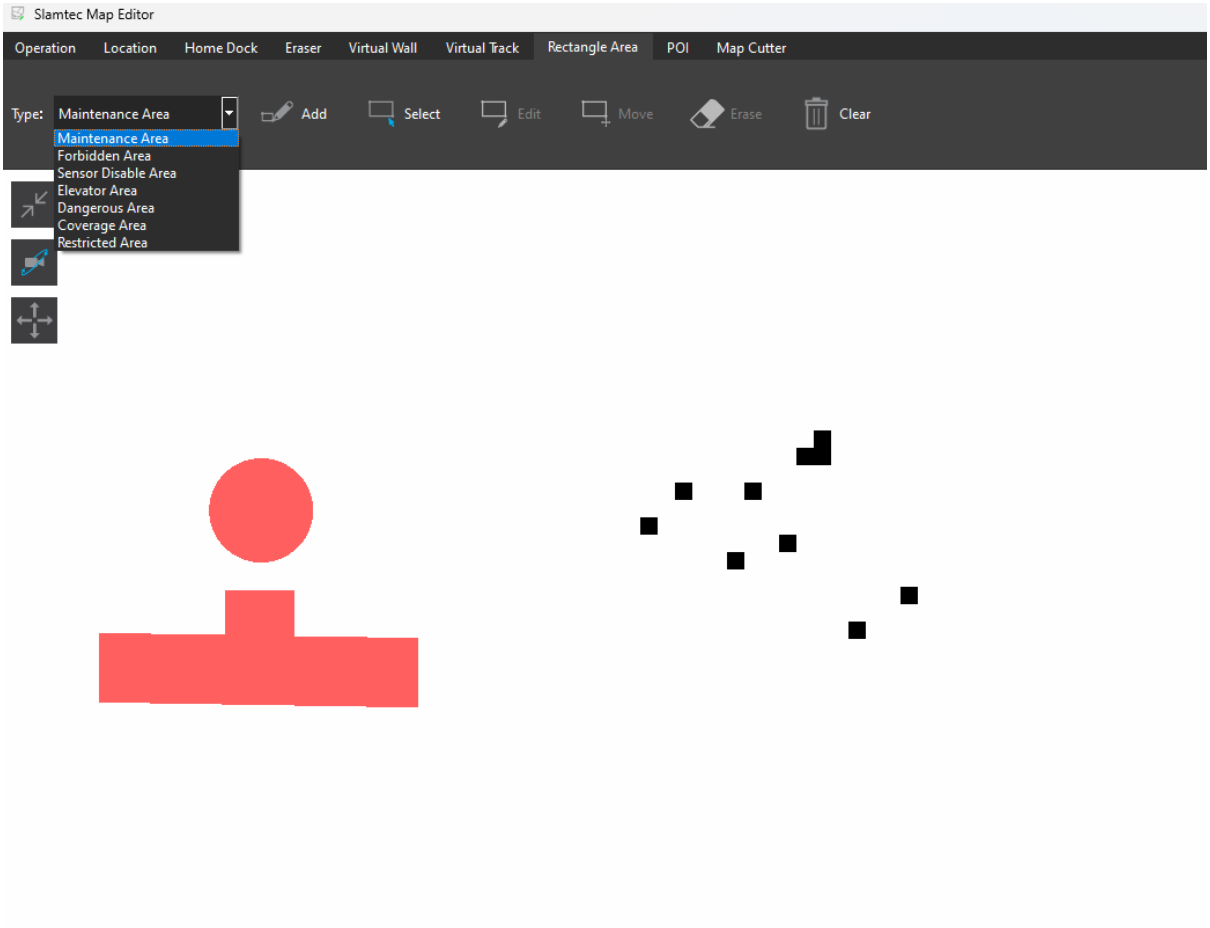


Figure for Rectangle Area

POI

The functionality is similar to the star mark management in the main interface.

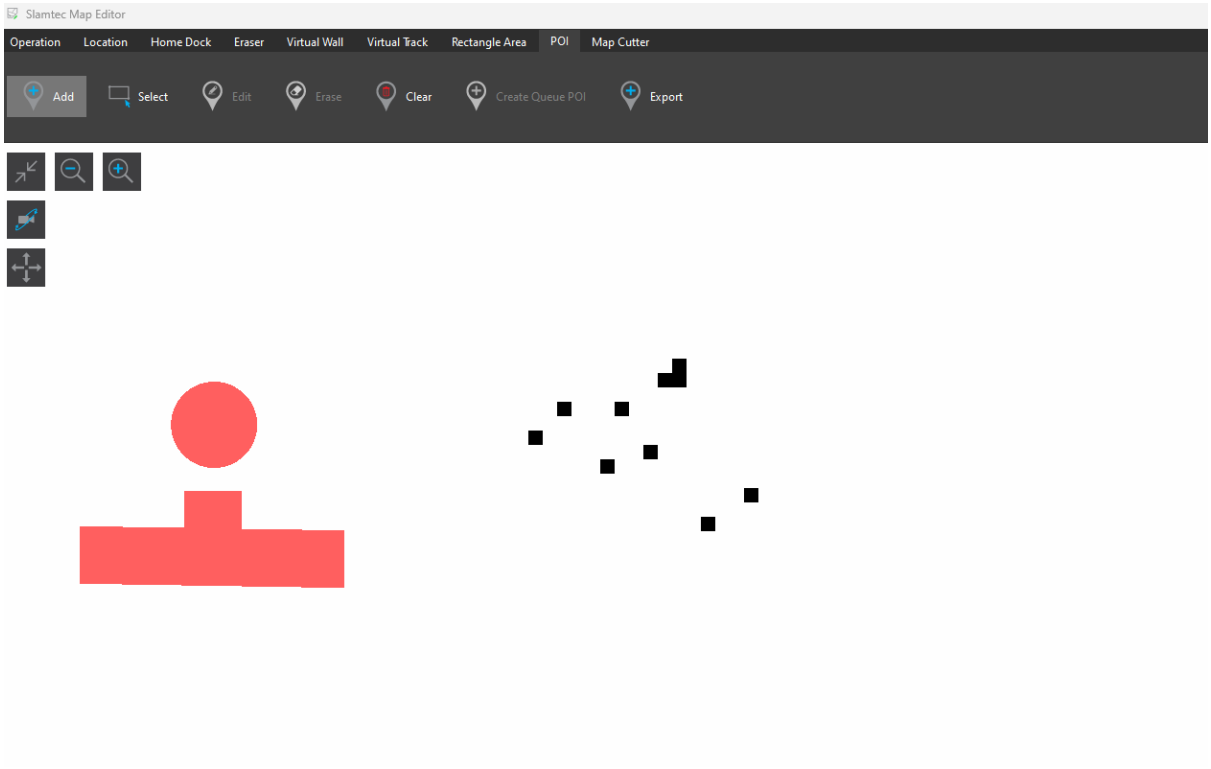


Figure for POI

Map Cutter

The **map cutter** function allows you to select the area of the map to be retained by drawing a box around it. The elements within the box, such as virtual walls and virtual tracks, will be completely preserved.

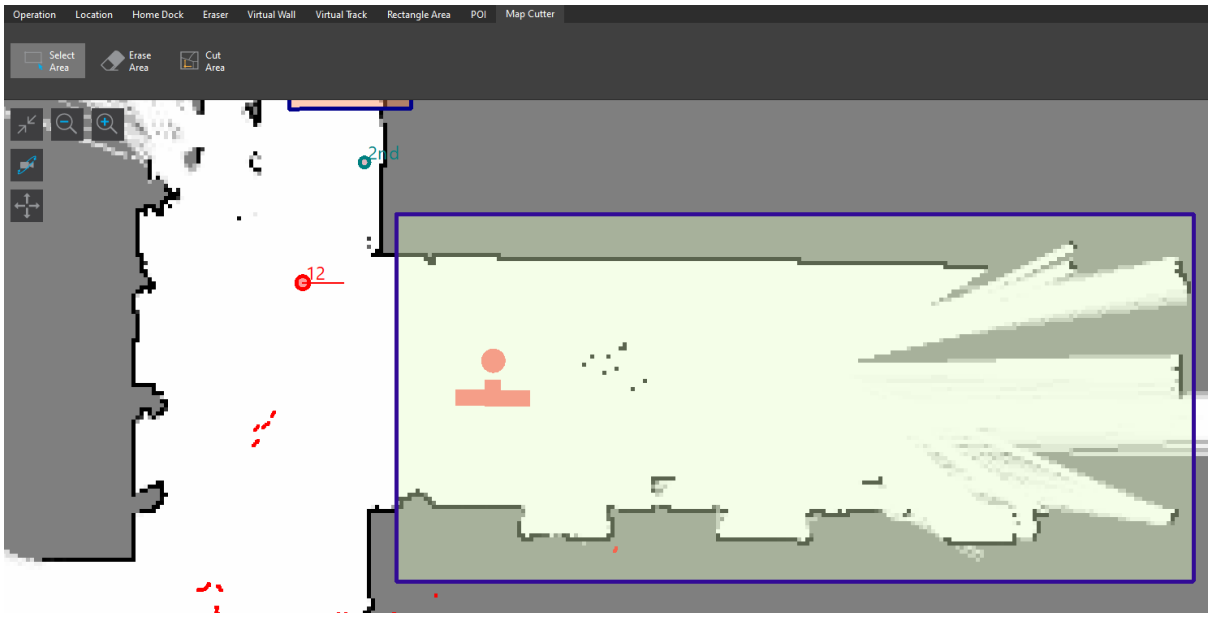


Figure for Map Cutter

If there is no **dock** within the cropping box, a pop-up window will remind you to confirm whether to continue cropping. After cropping, the origin will be reset to the center of the map.

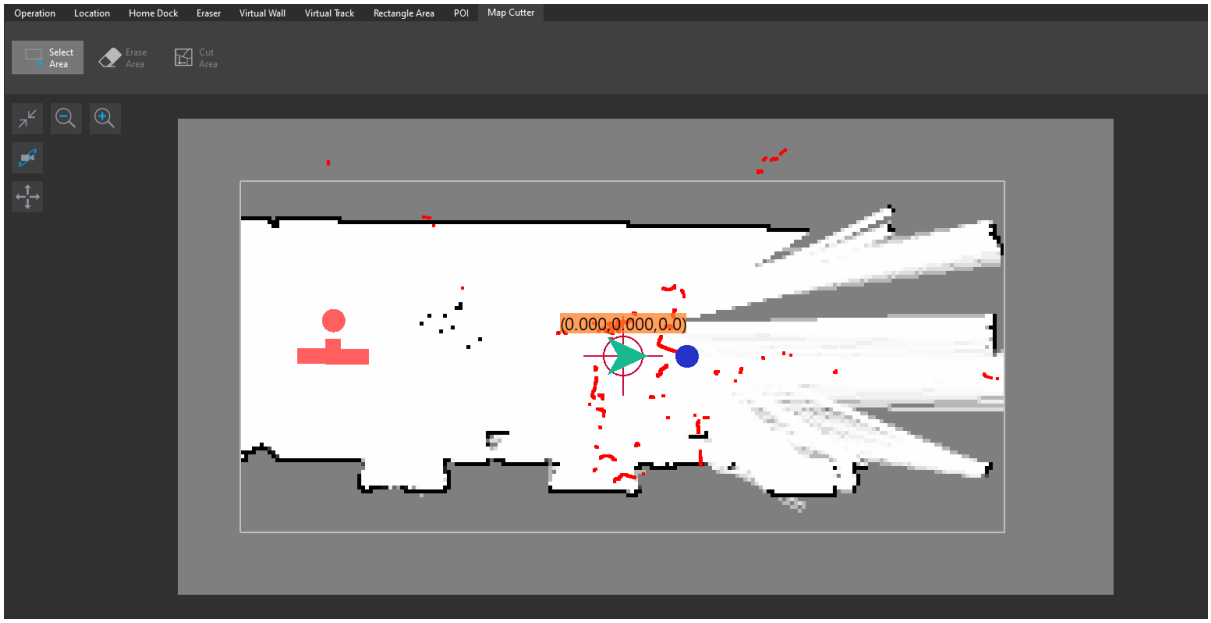


Figure of map after Map cutter

。

Multiple-Floor Map Editor

Save to File

Merge several maps and save them to a file with the extension **.stcmx**.

Load From File

Click **Load from File** and select a multi-floor map from an **.stcmx** file.

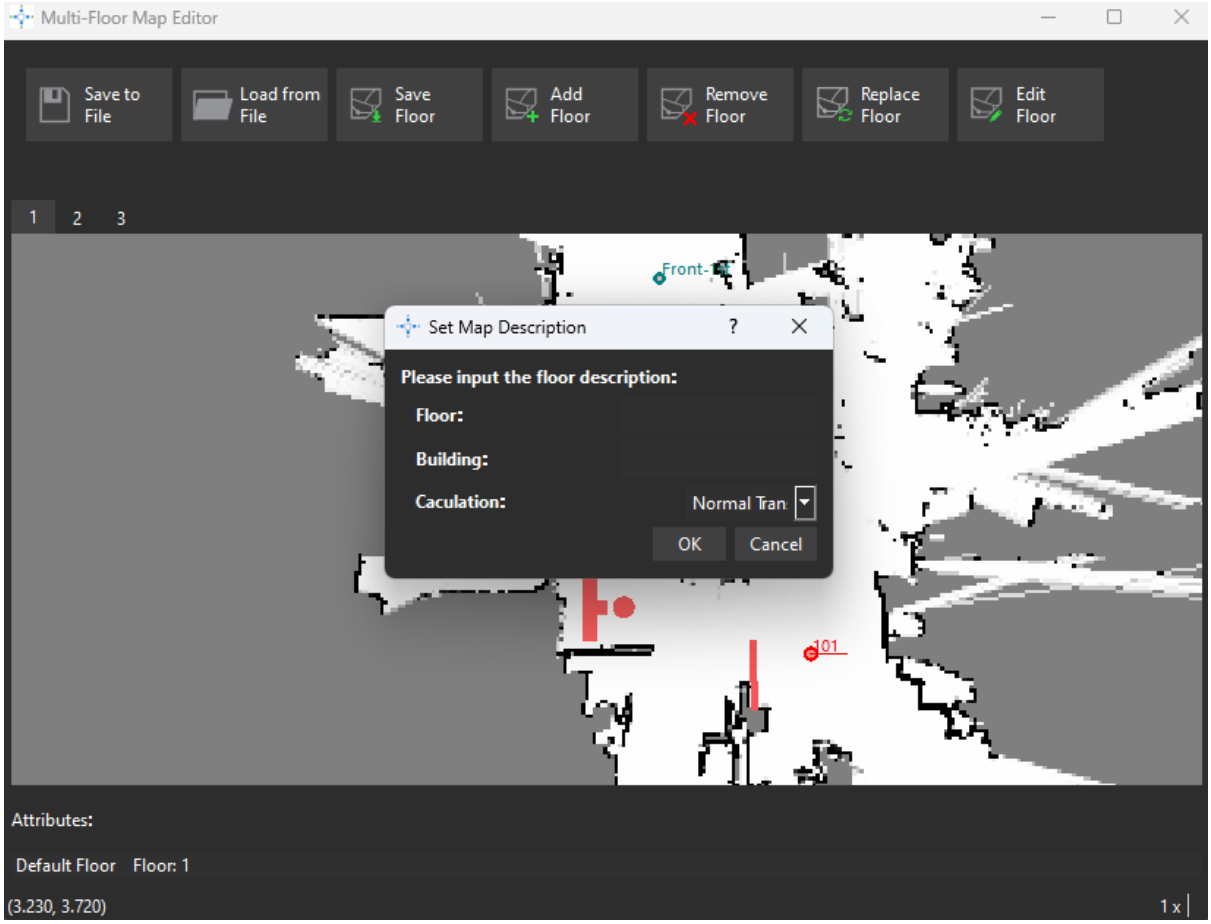
Save Floor

Click **Save Floor** of the current selected tab as an **.stcm** file.

Add Floor

Click **Add Floor** and upload an **.stcm** file to add to the current multi-floor map. When adding, you need to enter the floor and building name. The map must contain at least one elevator area, and the elevator ID must be consistent with the elevator ID of the existing floors. The first one added should be the default floor.

The default floor is not necessarily the first floor; it should be the floor where all elevators stop. When needing to transfer elevators, the robot needs to go to the default floor first.



Remove Floor

Click the tab **Remove Floor to** delete the current floor map.

Replace Floor

Click the tab **Replace Floor** and select an **.stcm** file to replace the current floor.

Edit Floor

Click the tab **Edit Floor** to edit the current floor.

Adjust Floor Sequence

The floor sequence is used to display the map by order, usually from bottom to top, but it can also be customized. You can adjust the order by dragging the **tab pages** of the map shown in the figure below.

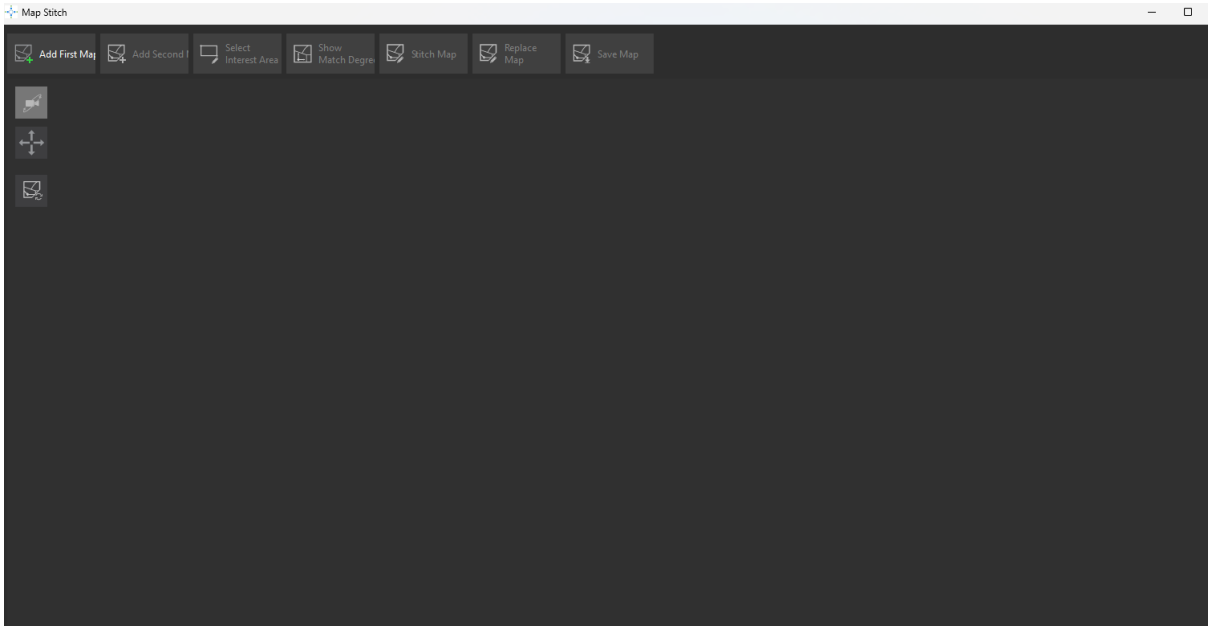
Map Stitch

Overview

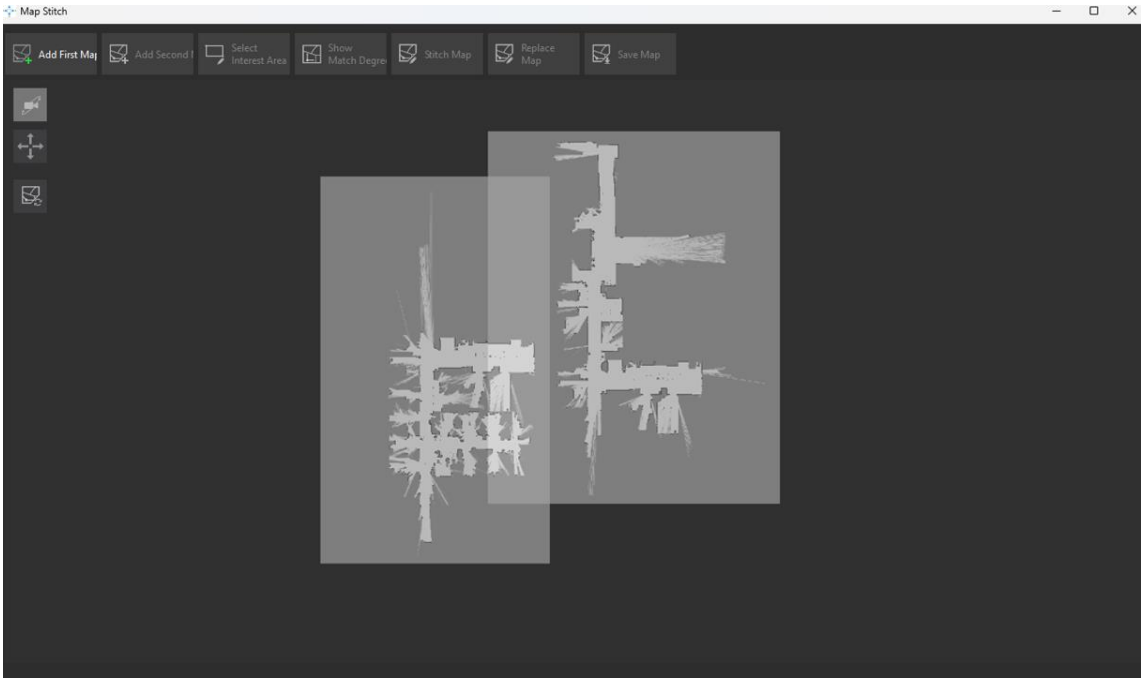
Map stitching can be used to merge the maps of two contiguous areas into one map or to replace the incorrect part of the original map with the correct part of another map. This helps to reduce the difficulty of building large scene maps and decreases the workload of post-operation and maintenance.

Add map

In toolbar menu, click **Map Stitch Editor** to display the following interface:



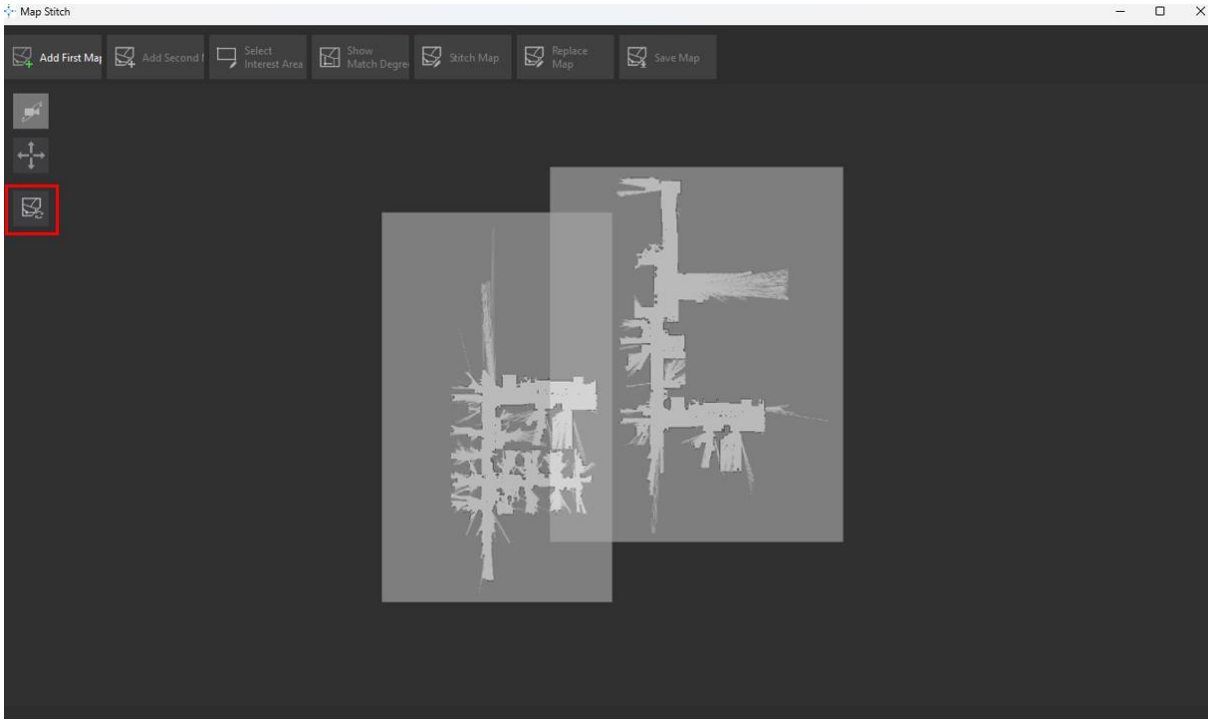
Next click **Add First Map** and **Add Second Map** to add the maps that need to be spliced.



Operate Map

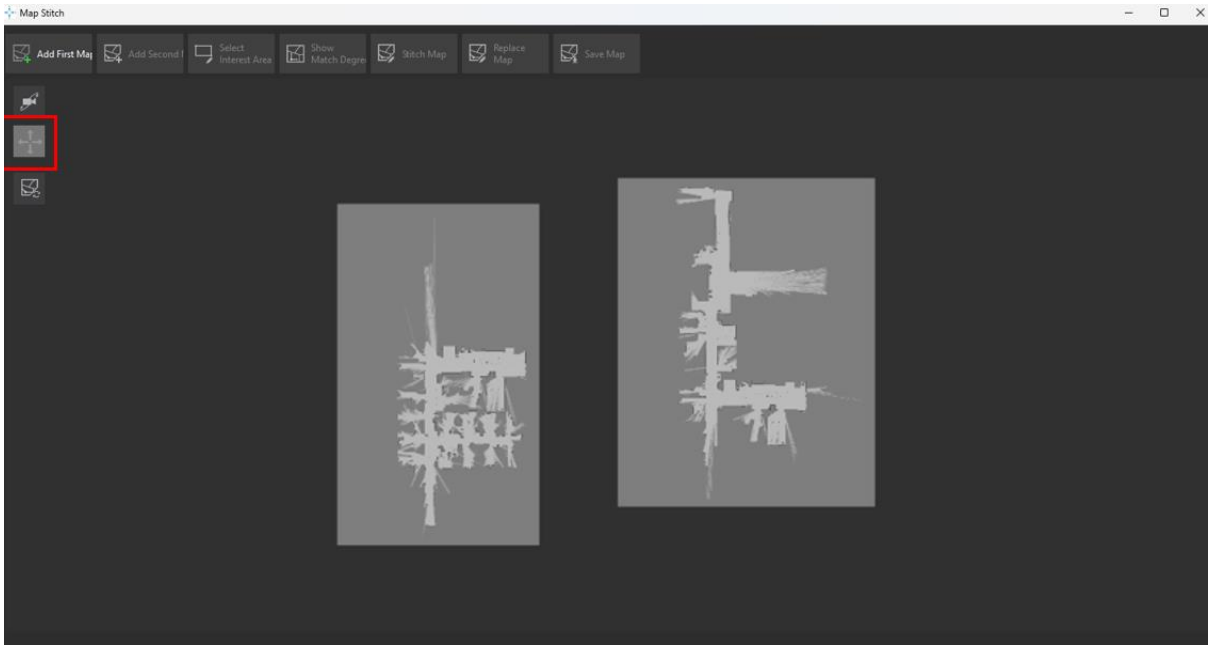
Switch between maps:

Click the button within the red box to switch to the map you want to operate on. The first map only supports translate camera and does not support rotation camera, while the second map supports both rotation and translate camera.



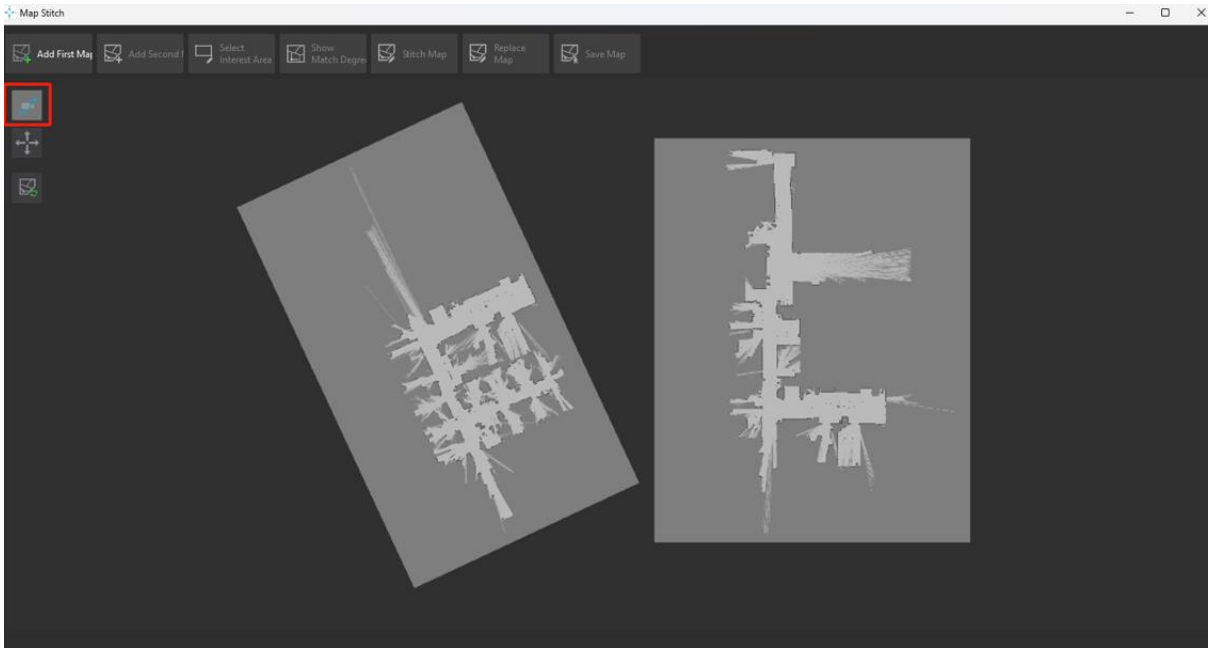
Move map:

You can move the map by clicking the **translate camera** within the red box, then right-click and drag the map.



Rotate Map:

Click the **Rotate Camera** button within the red box, then left-click and drag to rotate the map.

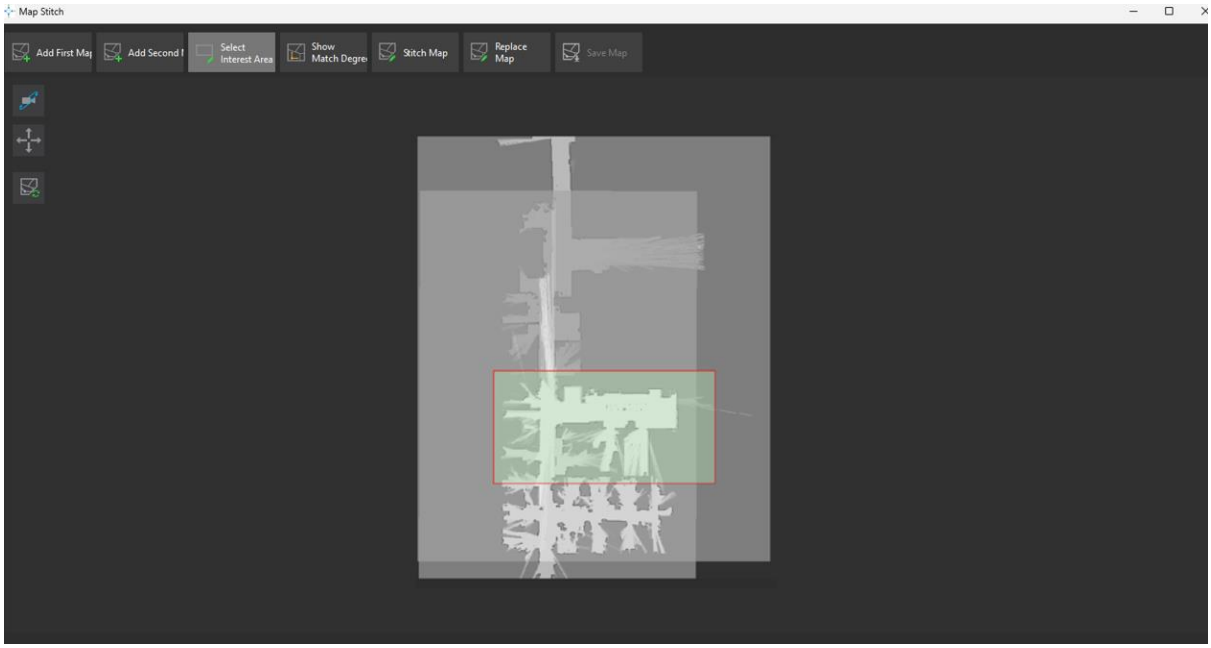


Zoom Map:

Zoom the map by scrolling up and down with your mouse wheel.

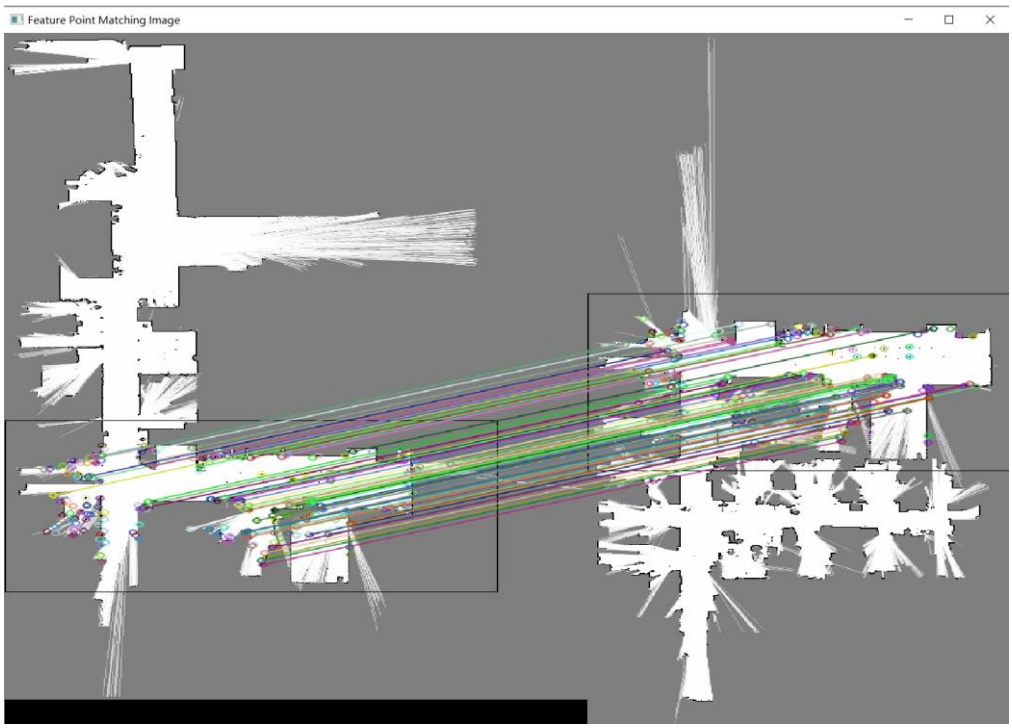
Select Interest Area

Drag the map to overlap the similar areas of the two maps. Click the **Select Interest Area** button to choose the area of interest. The selection of the area of interest will affect the final stitching result to some extent.

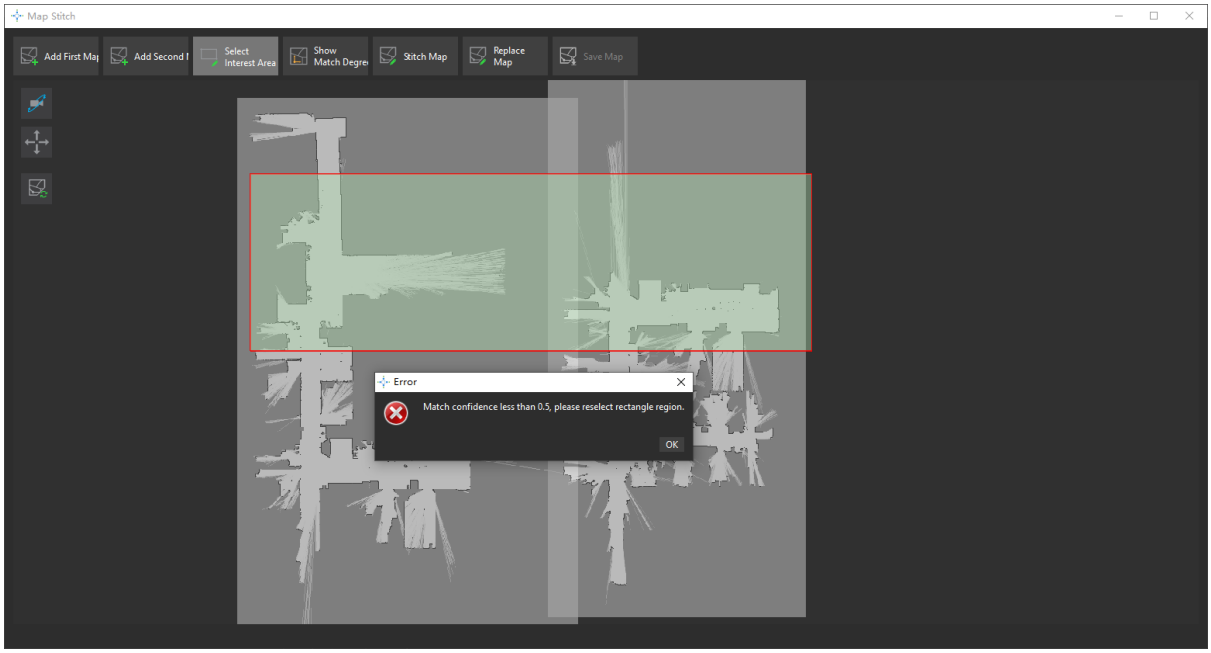


Show Match Degree

Click **Show Match Degree** button to display the map matching results. Users can judge the quality of the final stitching result based on the accuracy of the matching connections. Generally, the more correct connections there are, the higher the accuracy of the map stitching result.

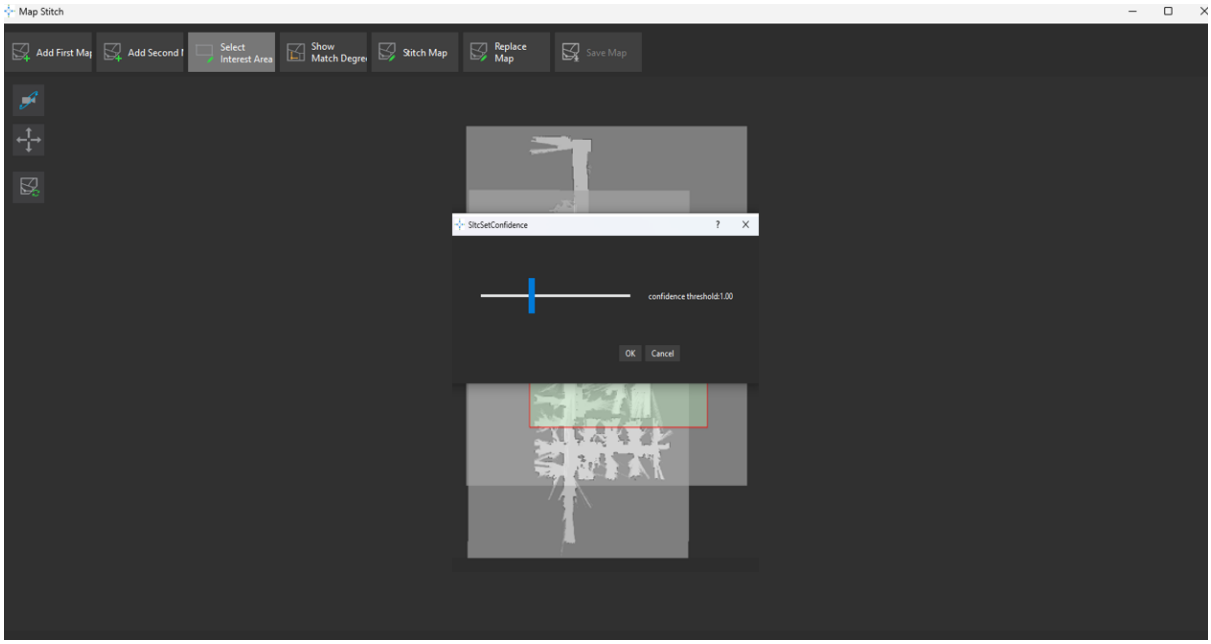


If a error prompt appears after clicking the **Show Match Degree** button, it means that the map cannot be stitched. You need to reselect the matching area or choose a higher quality map for stitching.

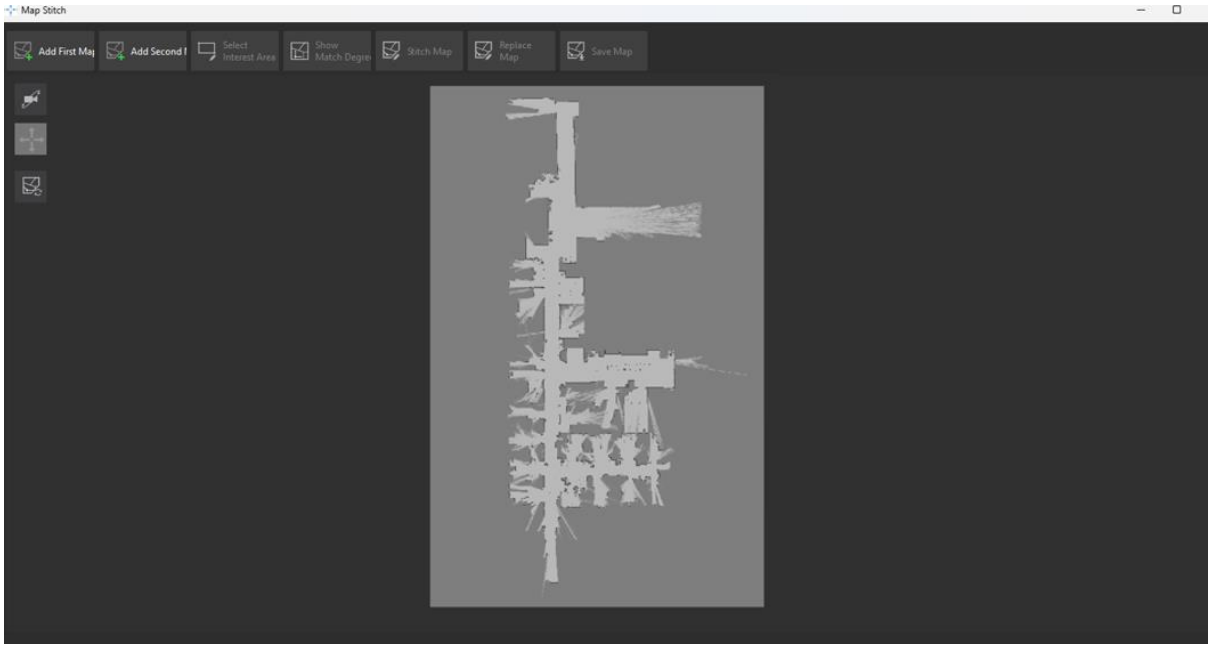


Stitch Map

After selecting the map, click the **Stitch Map** button to perform the map stitching. A confidence threshold selection box will pop up:



After selecting the appropriate threshold, click **OK** to complete the map stitching. Users need to note that the lower the confidence threshold is set, the worse the matching effect will be.



Replace Map

After selecting the matching area, click **Replace Map** to perform the map stitching. The steps are the same as map stitching, but the difference is that map replacement will prioritize using the information from the first map when stitching the similar areas of the two maps.

Save Map

Click **Save Map** to save the new map into an stcm file.

User guide

Map stitching can be used to merge the maps of two contiguous areas into one map or to replace the incorrect part of the original map with the correct part of another map.

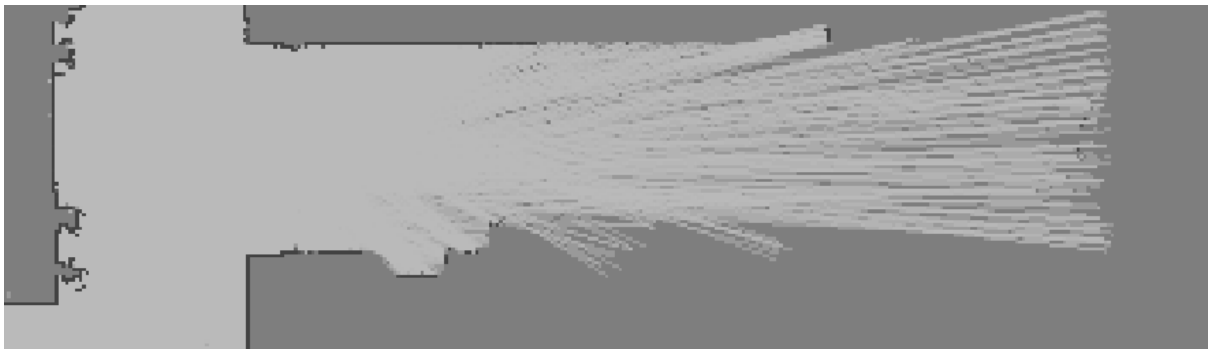
Although the map stitching window only displays the map outline information, but the virtual walls, tracks, rectangular areas that is inside the map will also be stitched simultaneously.

Map Selection:

The two maps to be stitched need to be contiguous areas, and the two maps need to have a common area, which is the similar area. The similar area needs to be larger than ten square meters. The larger the similar area between the two maps, the higher the success rate of stitching. The similar areas between maps need to have complete outline information, clear boundaries, and smooth

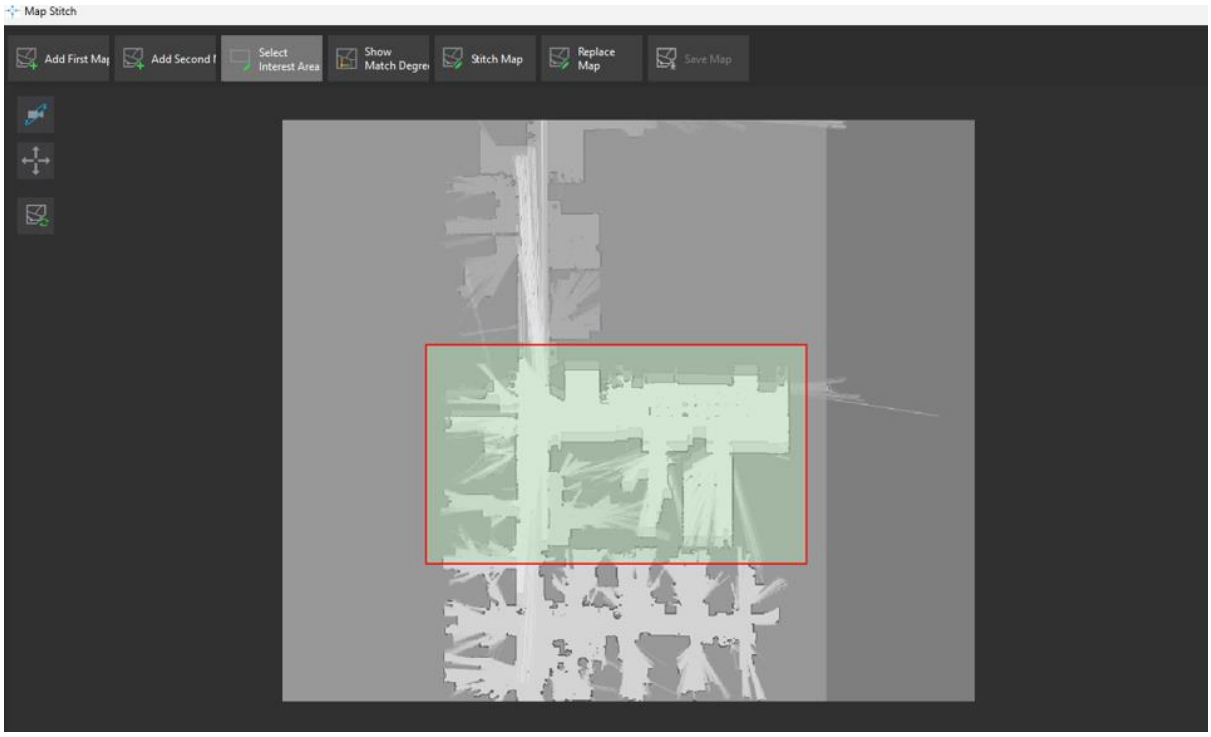
contours, as shown in the figure below. Each grid color should ideally be either black or white, as gray grids will affect the matching results to some extent.

If the outline information of the similar area is incomplete, as shown in the figure below, the map has uneven boundaries, the map construction is imperfect, and there are too many gray pixel values, there is a high probability that the stitching will fail or the accuracy of the stitching will decrease.

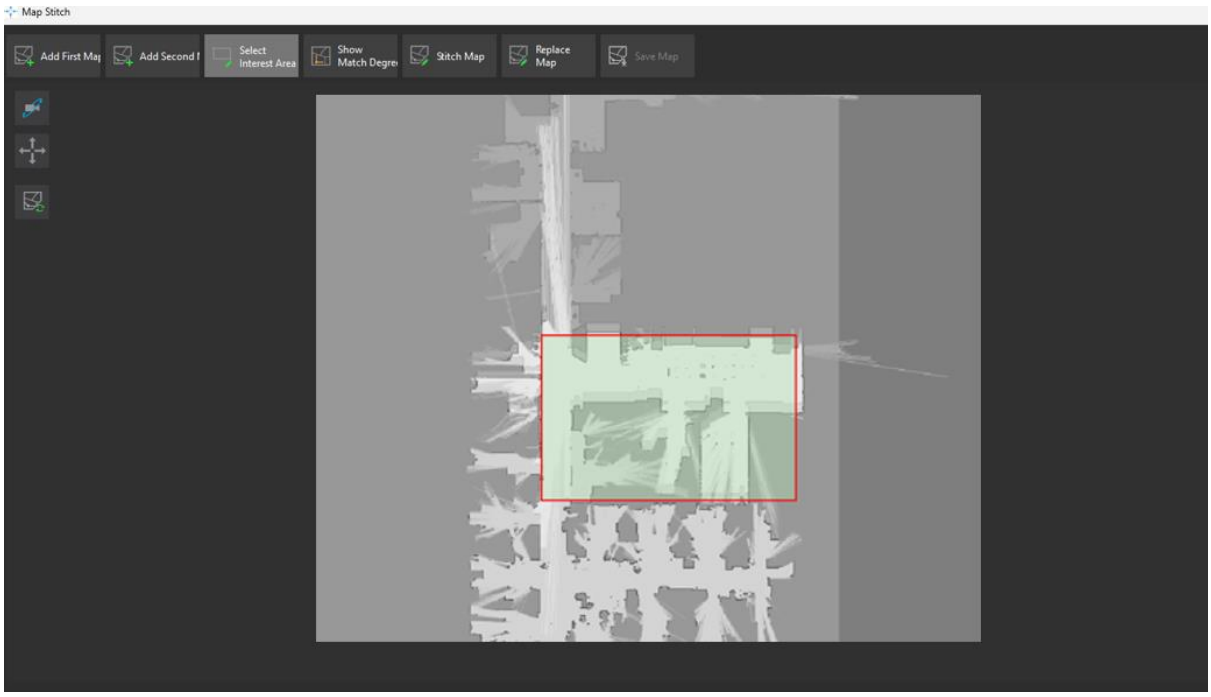


Select Interest Area：

When selecting the similar area, ensure that the pre-selection box is not too small; it is best to be slightly larger than the similar area. It needs to completely include the overlapping area of the two maps, as shown in the figure below:

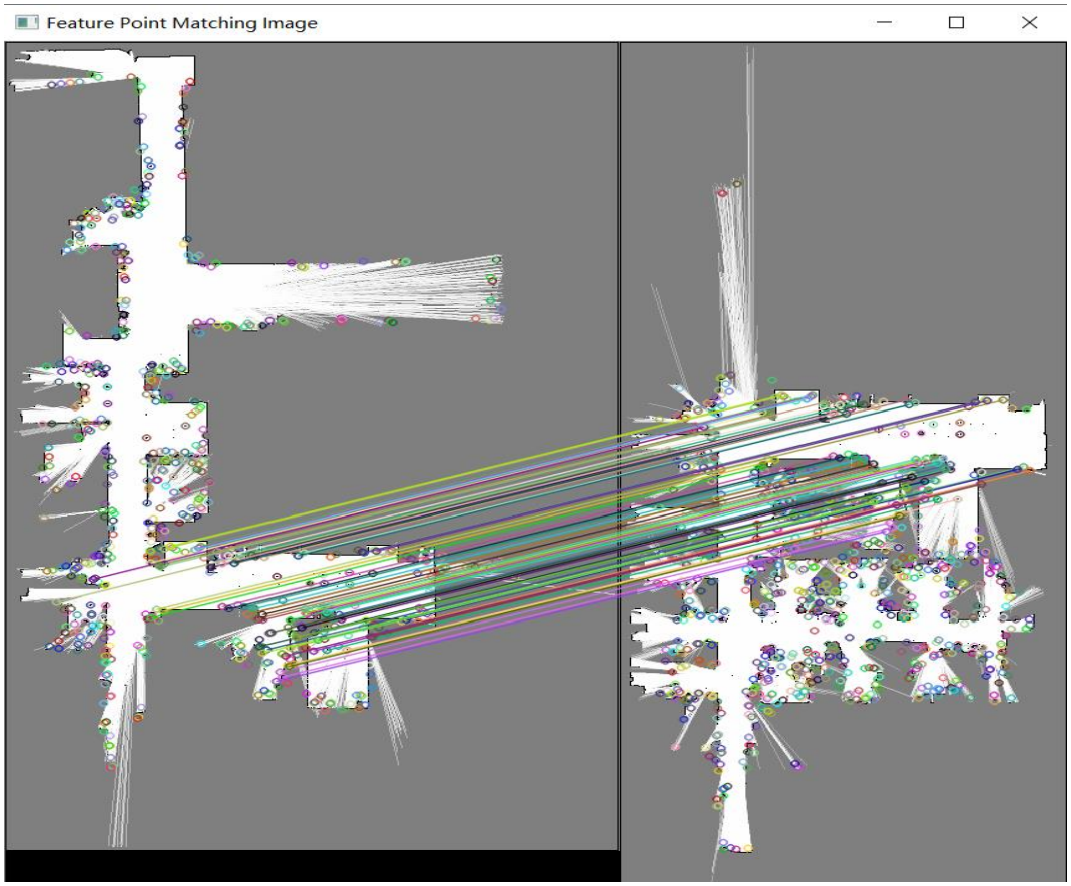


If the selection range is too small, it will cause the stitching to fail. An example of an incorrect selection is shown in the figure below:



Show Match Degree：

At least five correct matching connections are required. Too few matching pairs will cause the stitching to fail or reduce the accuracy. The more correct matching pairs there are, the higher the accuracy of the stitching.

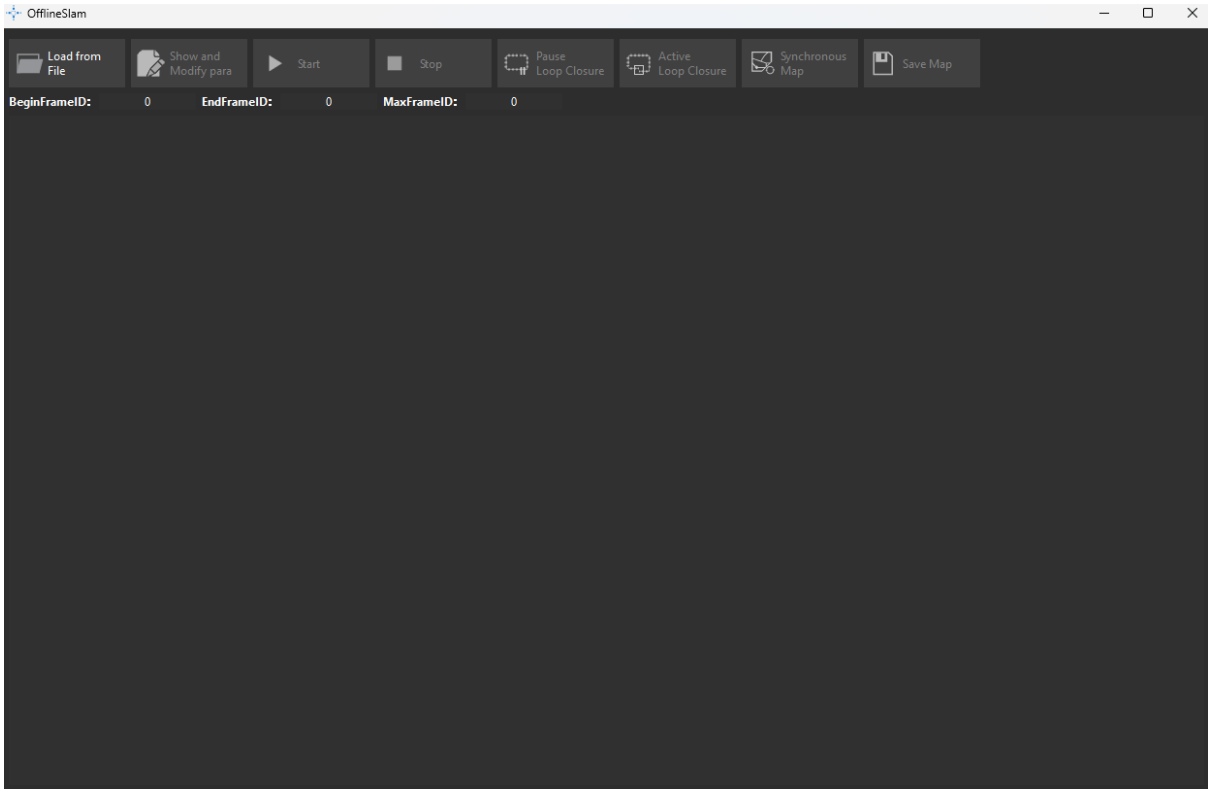


Stitch map:

Clicking the **Stitch Map** button will bring up the confidence threshold setting window, where users can choose the desired confidence threshold. The lower the threshold is set, the higher the probability of stitching success, but the accuracy of the stitching will be relatively lower. If a stitching failure is displayed, users can choose to lower the confidence threshold to increase the probability of success.

It should be noted that if the **Show Match Degree** button was not clicked before clicking the **Map Stitching** button, the confidence threshold is set to 1 by default. In this case, the stitching may fail, and users need to follow the prompts to modify the threshold or choose a higher quality map for stitching. If the **Show Match Degree** button is clicked before clicking the **Map Stitching** button, the confidence threshold setting window will provide a suitable reference confidence threshold. Users can directly click the **OK** button to complete the stitching or lower the threshold, but it should not be higher than the given reference threshold, as this will reduce the probability of stitching success.

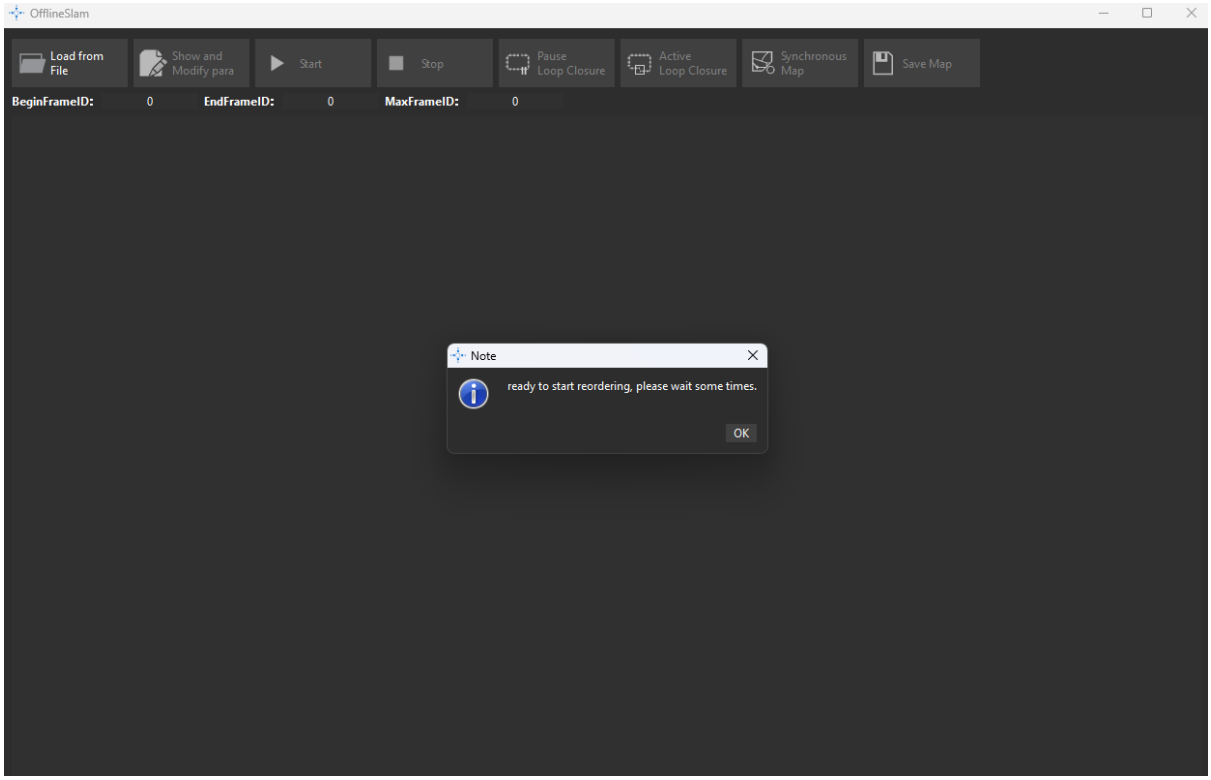
OfflineSlam

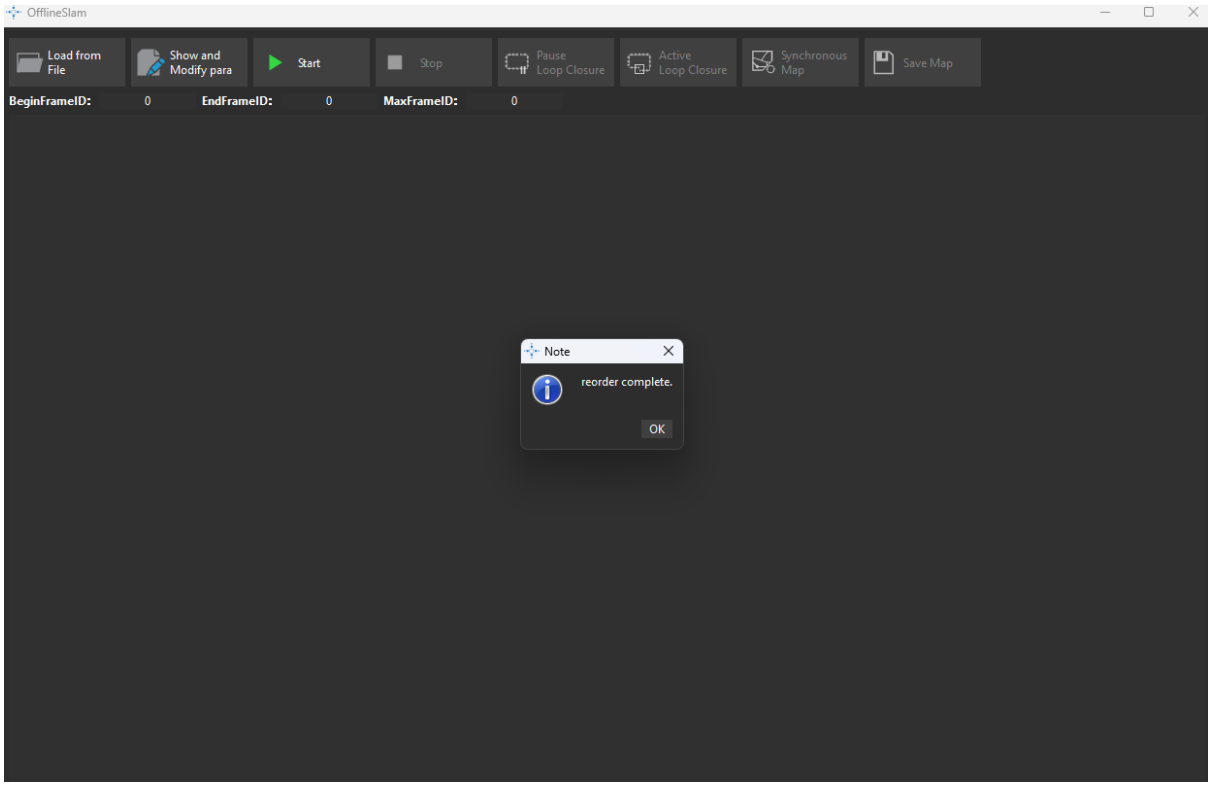


The offline mapping tool can perform offline map construction using recorded data packets. During the mapping process, you can manually select the map frame interval to be constructed, and loop closure optimization can be selected automatically or manually. The constructed map can be directly saved for editing, greatly reducing the difficulty and time required for robot deployment.

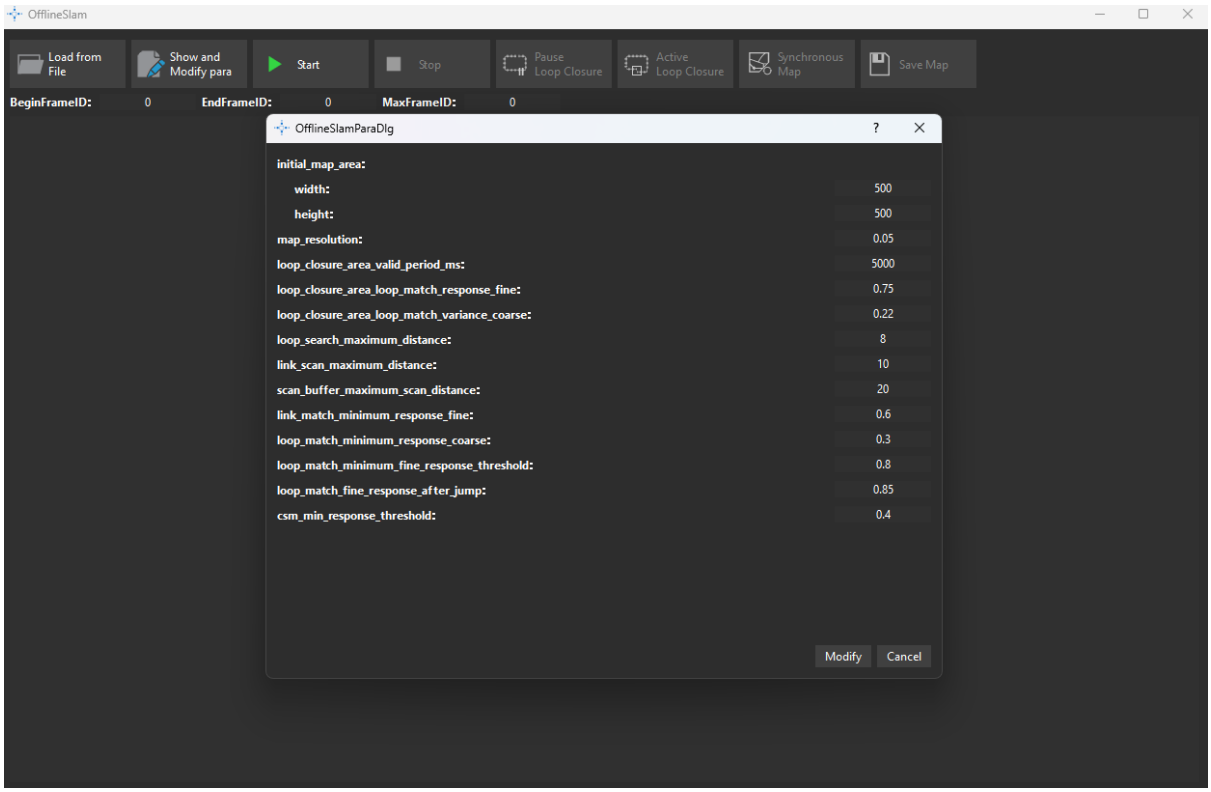
Operating procedure

First, click the **Load From File** button and select an existing **stms** data packet. During the loading process, the data will be rearranged in chronological order, and a please wait prompt will appear. Once completed the prompt will appear.

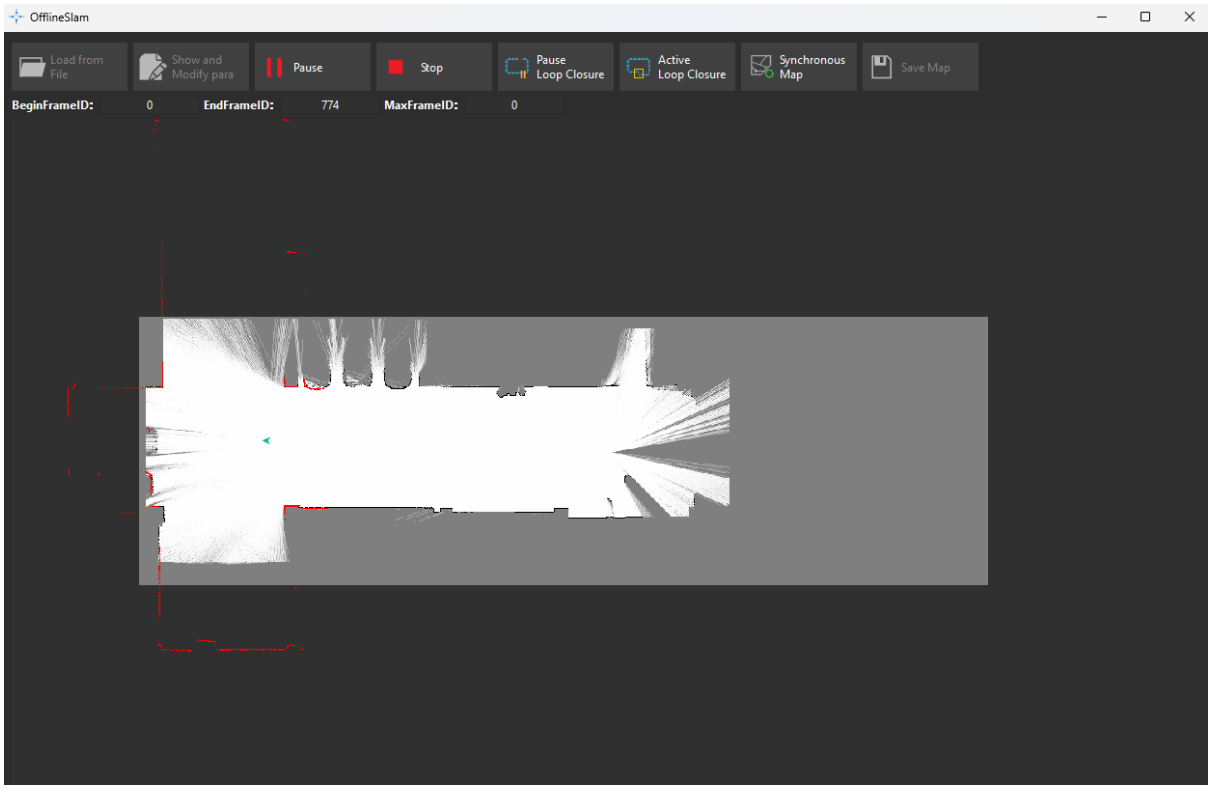




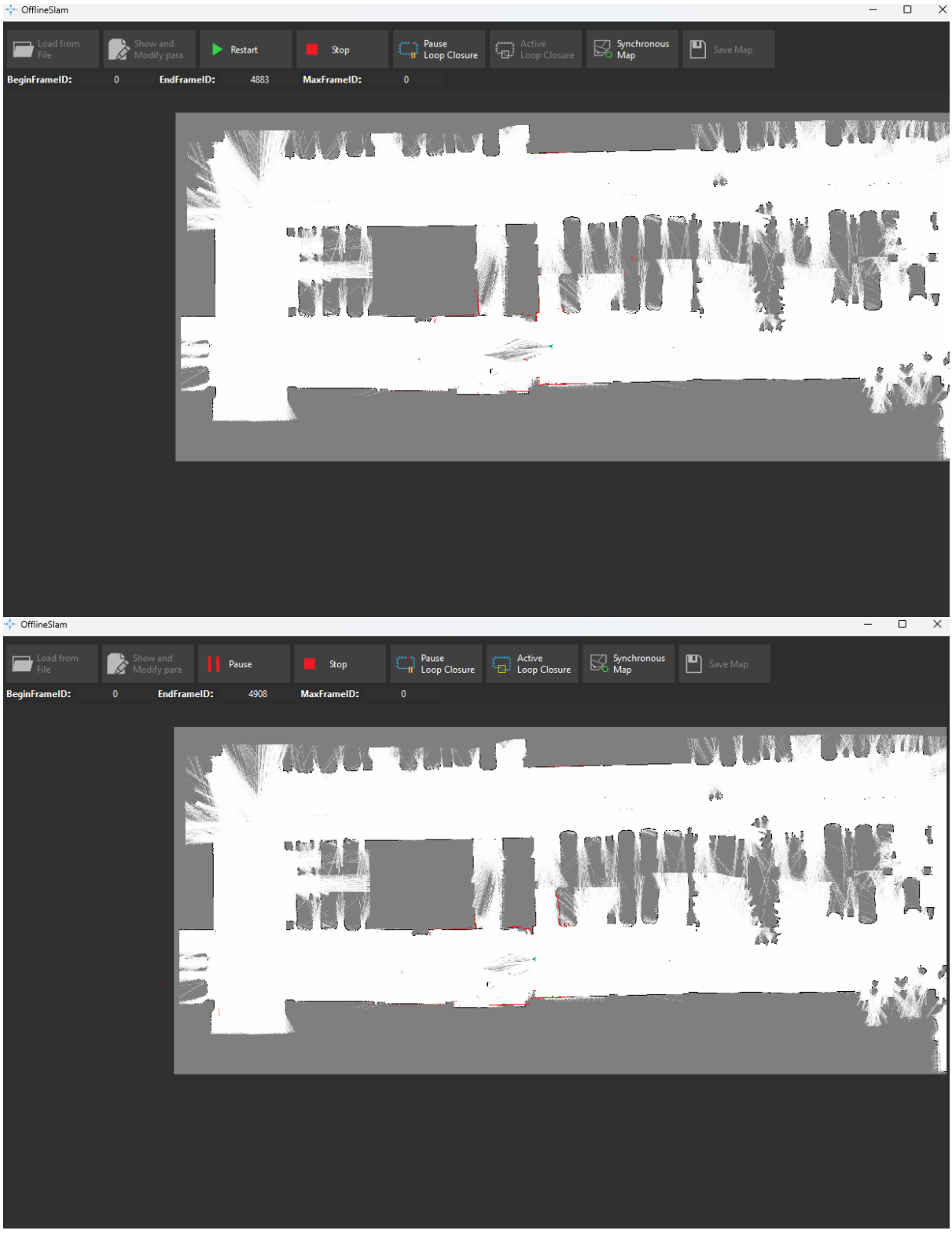
After loading the data packet file, you can click the **Show and Modify Para** button to view and modify some mapping-related parameters.



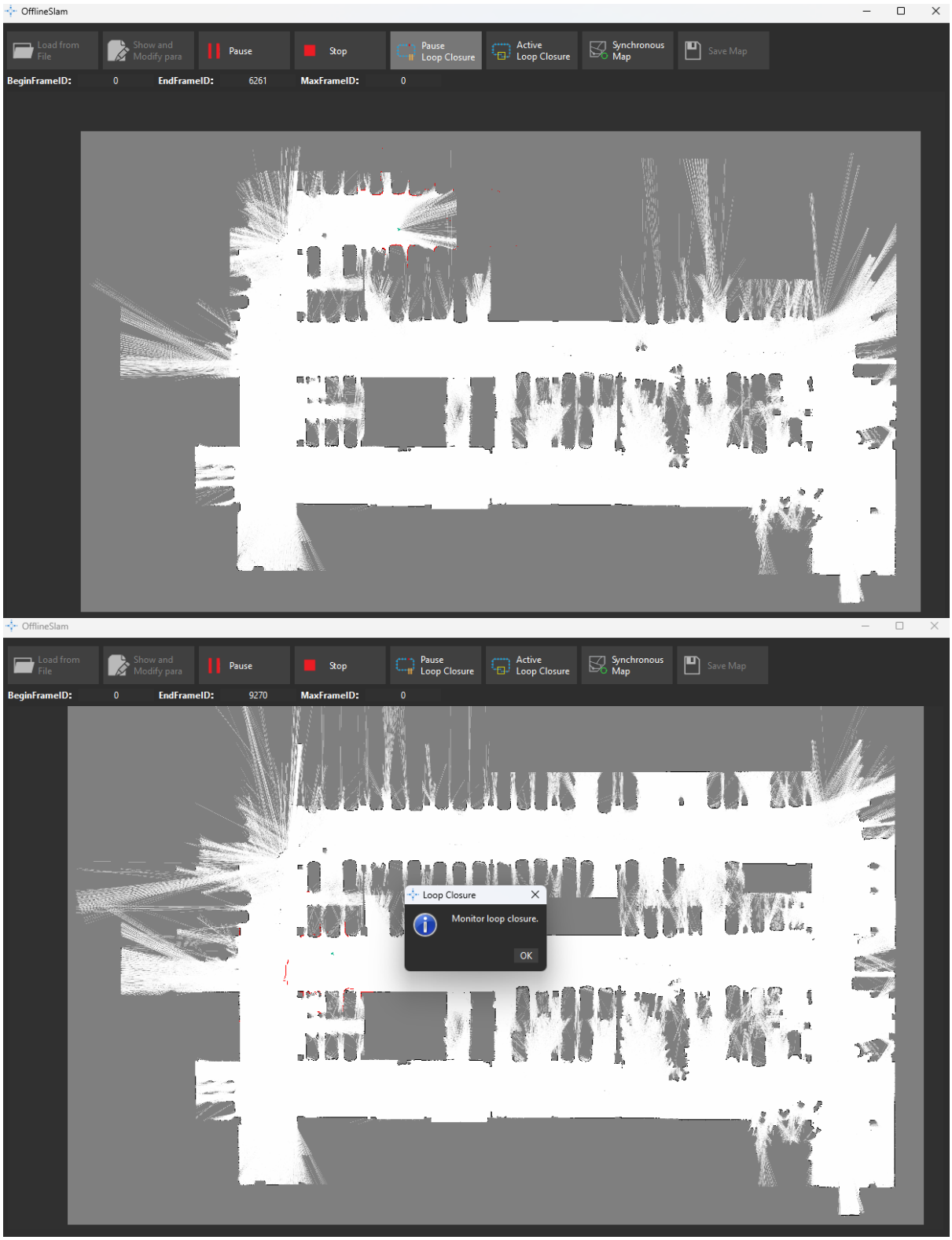
Click the **Start** button to begin the offline mapping process. The end frame ID will gradually increase. You can use the mouse wheel to adjust the display size of the map on the page, and the left/right mouse buttons to move the map position.



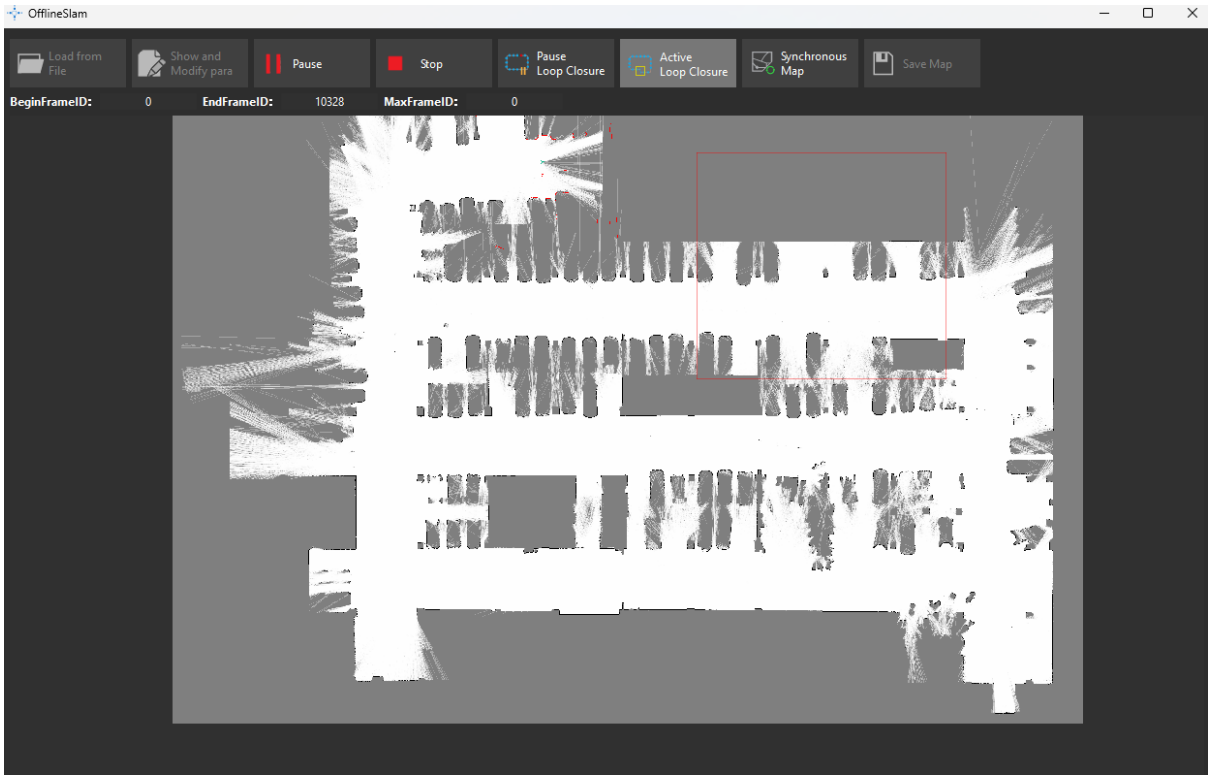
Click **Pause** button to stop the mapping at the current frame. The **Pause** button will switch to the **Restart** button. Click the **Restart** button to continue mapping.



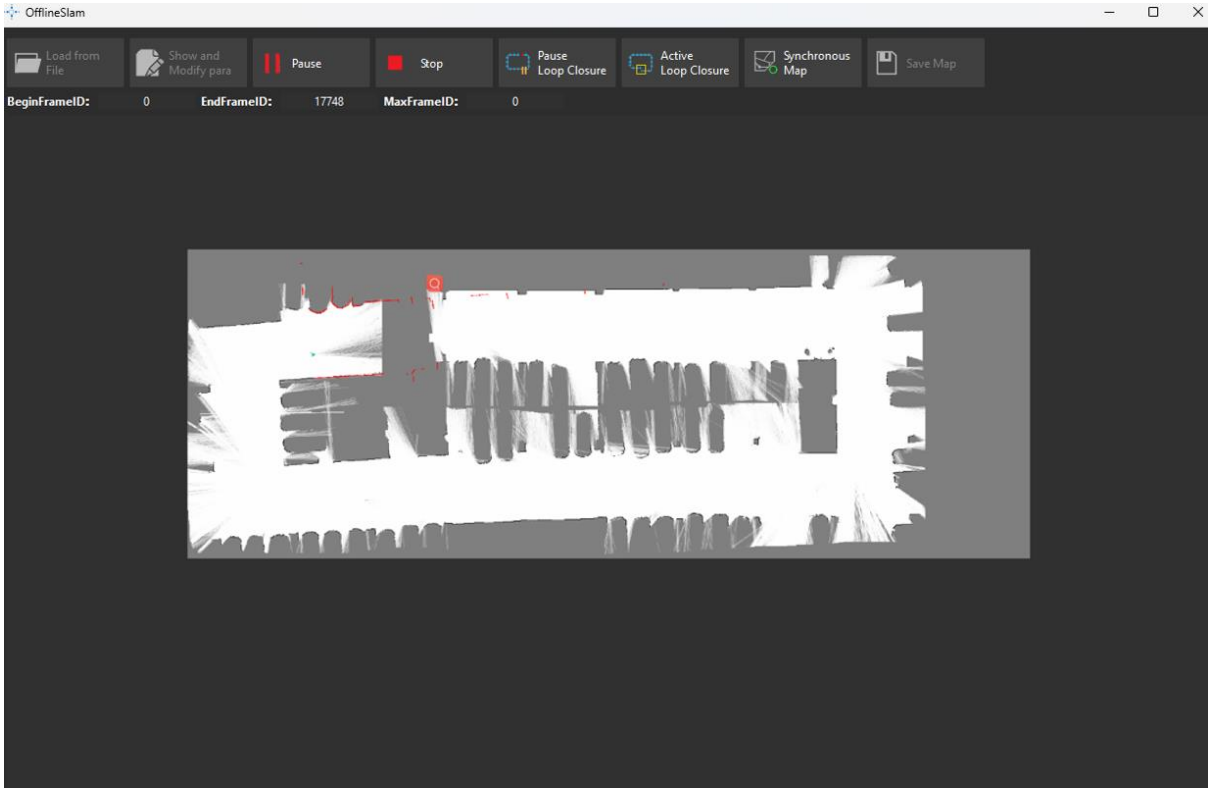
The automatic loop closure optimization function is enabled by default. If you do not need the automatic loop closure function, you can click the **Pause Loop Closure** button.

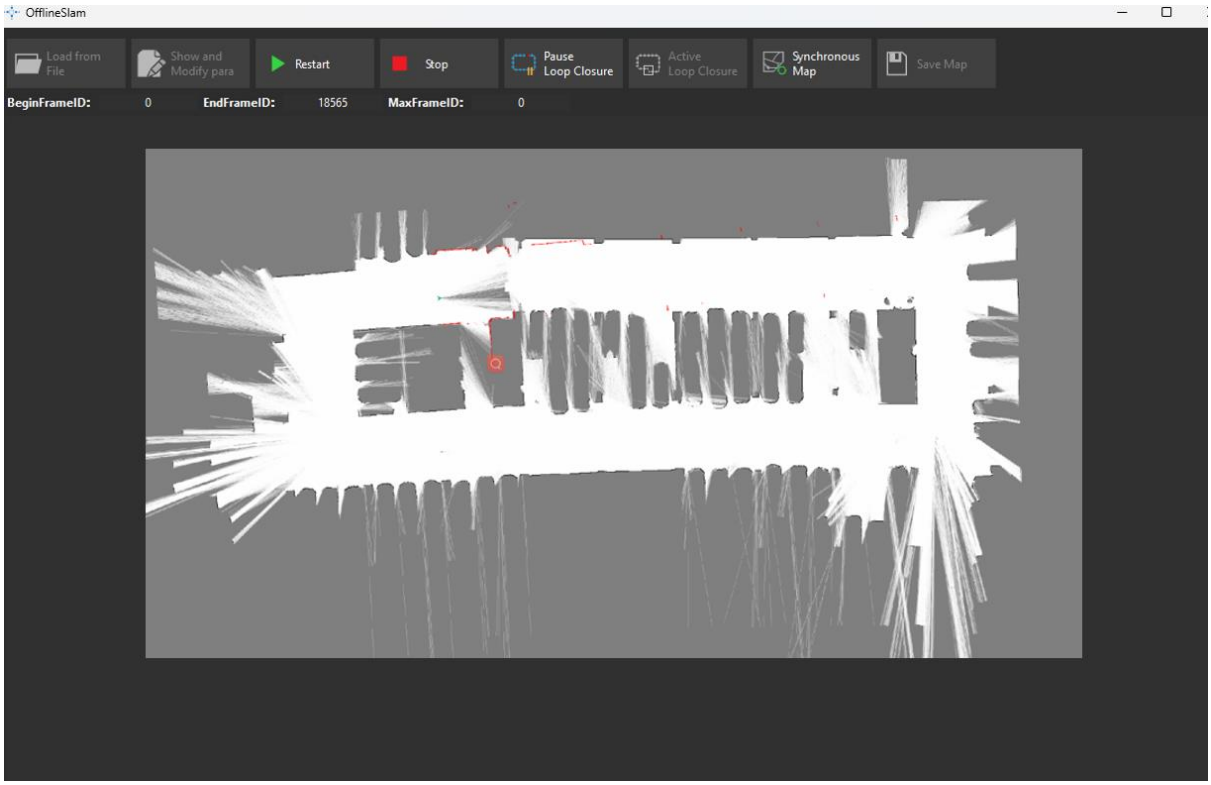


After pausing the automatic loop closure optimization, if you want to manually select the loop closure area, you can click the **Active Loop Closure** button and then draw a box in the potential loop closure area.



The **Synchronous Map** button fully synchronizes the updated map from the background to the interface. Considering that a full update is time-consuming, we only perform incremental updates of the map near the robot during the mapping process. A full update is only performed when a loop closure is detected.





If you have obtained a usable local map and do not want to continue mapping, you can click the **Stop** button. Then click the **Save Map** button to save the existing constructed map for use.

After completing offline mapping once, if you only want to construct the map for a specific frame segment, you can enter the frame interval in the start frame ID and end frame ID input boxes, and then click the **Start** button.

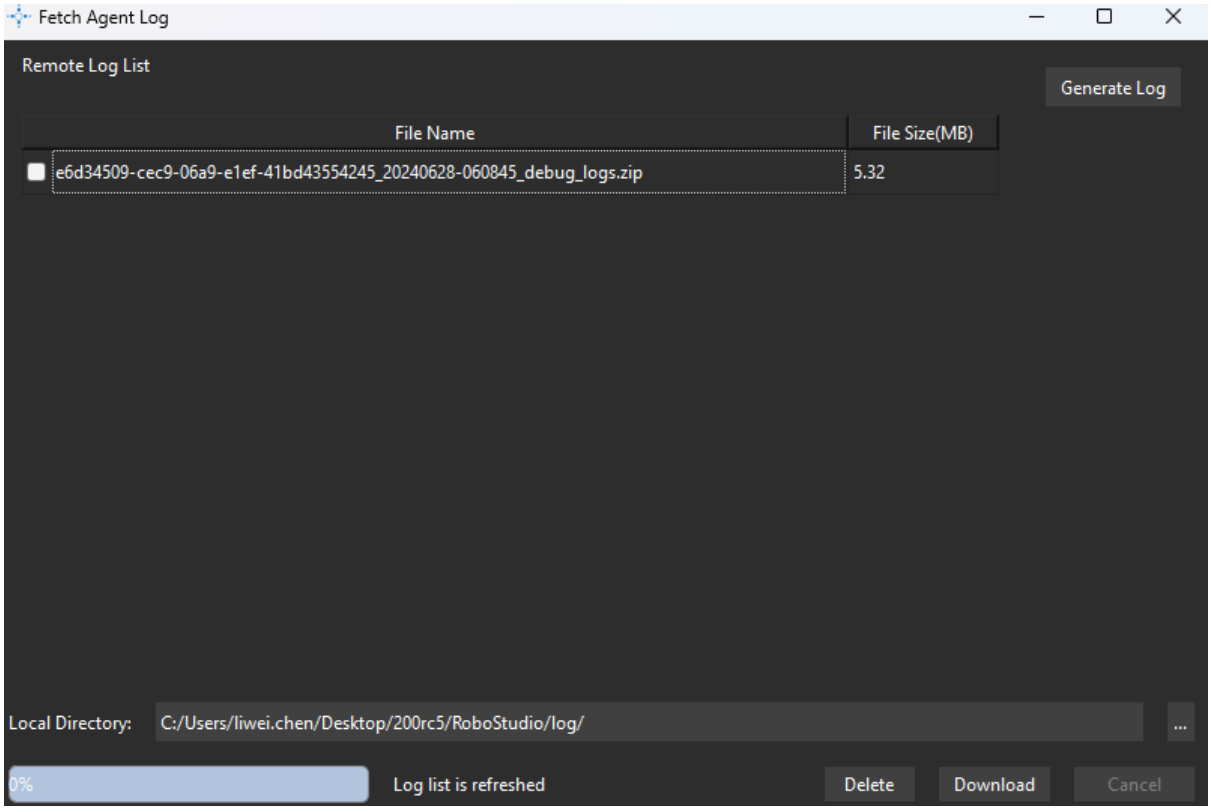
Precautions

- The first time the data packet file is loaded and sorted, a sorted file will be generated in the same directory. For subsequent use, you can use the sorted file to skip the sorting waiting process.
- Mapping parameters are generally not recommended to be modified to avoid deteriorating mapping results.
- Manual loop detection only detects the robot's current movement position. Selecting other areas will not successfully trigger loop detection.;
- Manual loop detection is highly dependent on the current frame situation. Selecting once may not stably trigger it, so it is advisable to select and detect multiple times within a short period.

- Before saving the map, you can manually click the **Synchronous Map** button to fully update the background map data before saving.;
- Some frame intervals for mapping depend on the frame data that has already been mapped, so the start and end frame IDs cannot be edited during the first mapping.
- The direction of some frame intervals for mapping may differ from the initial frame mapping direction. The map always uses the initial robot forward direction as the x-axis direction.

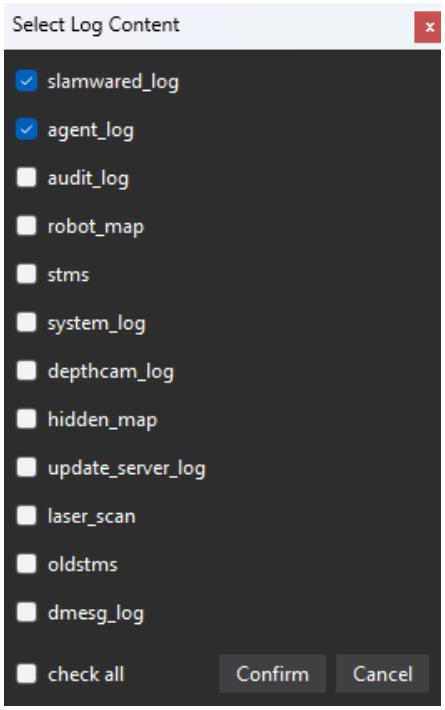
Fetch Agent Log

In the toolbar menu, the **Fetch Agent Log** button allows you to capture log files for analysis through the agent service. This entire function operates asynchronously, which means it is not affected by network fluctuations, unlike the existing **Fetch All Debug Data** button, which operates synchronously.



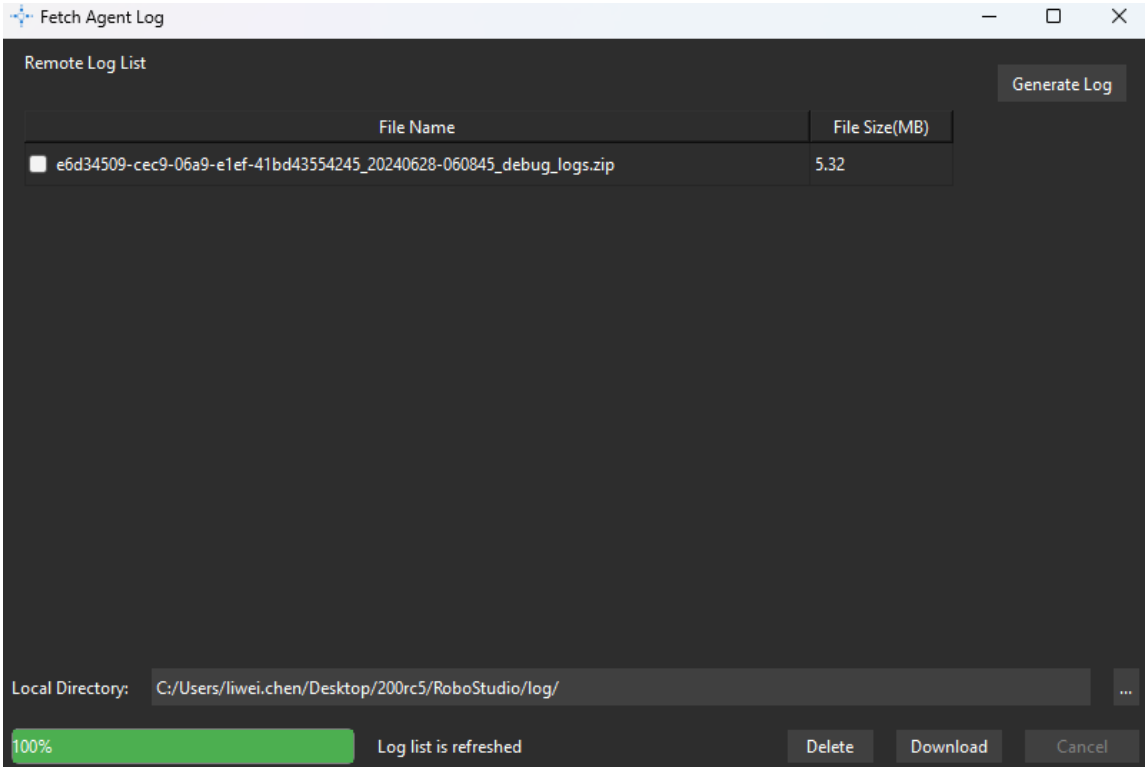
Operating procedure

Click the **Generate Log** button at the top right corner. A window will pop up allowing you to select the types of log files you want to capture. After making your selections, click the **Confirm** button in the figure below. The agent service will begin capturing the logs and will eventually compress them into a .zip file.



The progress bar at the bottom left shows the current progress of the asynchronous log capture. Once the capture is complete, the captured zip file will be displayed in the list.

After selecting the file, you can click the **Delete** or **Download** button to perform operations. After the file is downloaded, the captured zip file on the machine will also be deleted to avoid wasting disk space.



Menu Bar

Menu	Button	Icon	Description
File	Lidars		Lidars management. Start scan, stop scan and disconnect from the lidar. (FrameGrabber plugin installation is required.)
File	Robots		Robots management. Connect or disconnect the robot. There is no Robots button when the robot is in offline mode.
File	Map Editor		Open the map editor. Edit the pose of the robot or the map.
File	Slamware Config Tool		Open the Config Tool. Load, edit and save robot configuration information.
File	Map Splicer		Open the map splicer window and splice the two maps
View	Focus Robot		Locate the robot and put it in the central of the interface.
View	Switch to full screen		Switch between full screen and window mode.
SLAM	Pause Localization		Start/pause localization.
SLAM	Recover Localization		Start recovering localization and robot pose in the efficient area. Recovering localization requires the RoboStudio has the recovering localization plug-in installed and connected to the device which supports recovering localization feature.
SLAM	Pause Mapping		Start/pause mapping.
SLAM	Map Eraser (White)		The area painted as white is a known place without obstacles. Reduce the eraser by pressing “[“, and enlarge it by pressing “]”.
SLAM	Map Eraser (Grey)		The area painted as grey is an undiscovered place, which means whether there is obstacles is unknown. Reduce the eraser by pressing “[“, and enlarge it by pressing “]”.
SLAM	Clear Map		Clear the robot map.
SLAM	Sync Map		Update the map with the robot.
Motion	Set way point		Set target points on the chosen path.
Motion	Go Home		Go back to the charging station.

Motion	Turn Left		Click the icon, or click the ← key in keyboard.
Motion	Turn Right		Click the icon, or click the → key in the keyboard.
Motion	Move Backward		Click the icon, or click the ↓ key in the keyboard.
Motion	Move Forward		Click the icon, or click the ↑ key in the keyboard.
Virtual Wall	Draw Line Wall		Add a line wall.
Virtual Wall	Draw Rectangle Wall		Add a rectangle virtual wall.
Virtual Wall	Draw Curve Wall		Add a curve virtual wall.
Virtual Wall	Select Wall		Choose a virtual wall.
Virtual Wall	Move Wall		Move virtual wall. Move the chosen virtual wall to a different place or move one of the endpoints of the wall to change its length and direction.
Virtual Wall	Erase Wall		Remove the chosen virtual wall.
Virtual Wall	Clear Walls		Remove all virtual walls.
Virtual Track	Line track		Add a line virtual track. The RoboStudio needs virtual track plug-in installed and the robot should support virtual track. Feature.
Virtual Track	Curve track		Add a line virtual track. The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.
Virtual Track	Select Track		Choose a virtual track. The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.
Virtual Track	Move Track		Move the virtual track. Click **Move Track** to move the chosen virtual track to a different place or move one of the endpoints of the track to change its length and direction. The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.
Virtual Track	Erase Track		Remove the chosen virtual track. The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.
Virtual Track	Clear Tracks		Remove all the virtual tracks.

			The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.
Virtual Track	Virtual Track Aided Naviagtion		Enter virtual track aided navigation mode. The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.
Forbidden Area	Draw Forbidden Area		Add forbidden area. The RoboStudio needs Forbidden Area plug-in installed and the robot should have Forbidden Area feature.
Forbidden Area	Select Forbidden Area		Select forbidden area. The RoboStudio needs Forbidden Area plug-in installed and the robot should have Forbidden Area feature.
Forbidden Area	Erase Forbidden Area		Romove the selected forbidden area. The RoboStudio needs Forbidden Area plug-in installed and the robot should have Forbidden Area feature.
Forbidden Area	Clear Forbidden Area		Remove all of the forbidden area. The RoboStudio needs Forbidden Area plug-in installed and the robot should have Forbidden Area feature.
Tool	POI		Open **POIs** list.
Tool	Plugin		Open **Plugin Manager** dialog box.
Help	About Slamtec		Software information.
Help	Language		Language setting.

Figure 3.1.1 Menu bar function list

Major Work Area Button

Button	Icon	Description
Full screen		Switch from full screen mode to window mode or vice versa.
View mode		Switch between free mode, tracking mode, locking mode.
Zoom out		Zoom the map viewpoint out.
Zoom in		Zoom the map viewpoint in.
Navigation		Enter default navigation mode.
Virtual track navigation		Enter virtual track navigation mode. The RoboStudio needs virtual track plug-in installed and the robot should support virtual track feature.
Translate camera		Translate the camera: click the icon, and then hold left mouse button down and drag the map to translate it.
Rotate camera		Rotate the camera: click the icon, and then hold left mouse button down and drag to switch between different views.
Display settings		Display settings. According to actual needs, choose what kind of data (Laser points, impact sensor, cliff sensor or ultrasonic sensor) to display.

Figure 3.2.1 Major work area function list

Date	Version	Description
2017-06-14	1.0	Draft
2017-11-10	1.1	1. Added POI Management chapter; 2. Added Plugin Manager chapter; 3. Added POI and plugin icon in Figure 3.1.1 Menu Bar Function List
2018-03-16	1.2	1. Added Slamware Config Tool chapter; 2. Added Sensor Map chapter; 3. Added Lidars chapter; 4. Added Slamware Config Tool and Lidars button icons in Figure 3.1.1 Menu Bar Function List
2020-12-02	1.3	1.Added Virtual Track Aided Naviagtion chapter; 2.Updated the POI Management chapter; 3.Added Forbidden Area Management chapter; 4.Added Virtual Track Aided Naviagtion and Forbidden Area buttons icons in Figure 3.1.1 Menu Bar Function List

Image And Table Index