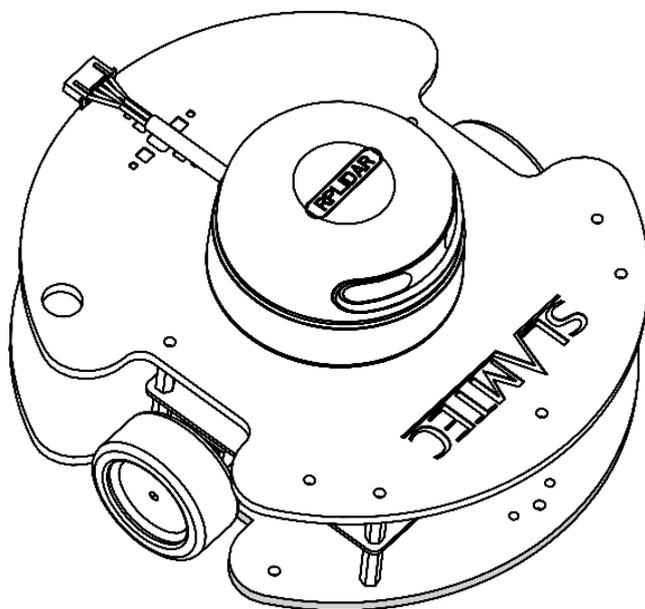


SLAMWARE

RoboStudio

User Manual



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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.

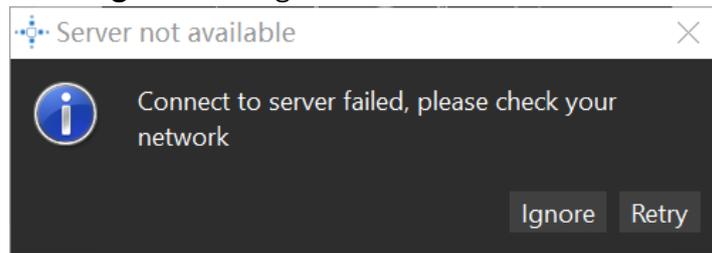


Figure 2.1.1 The prompt dialog box after launching offline

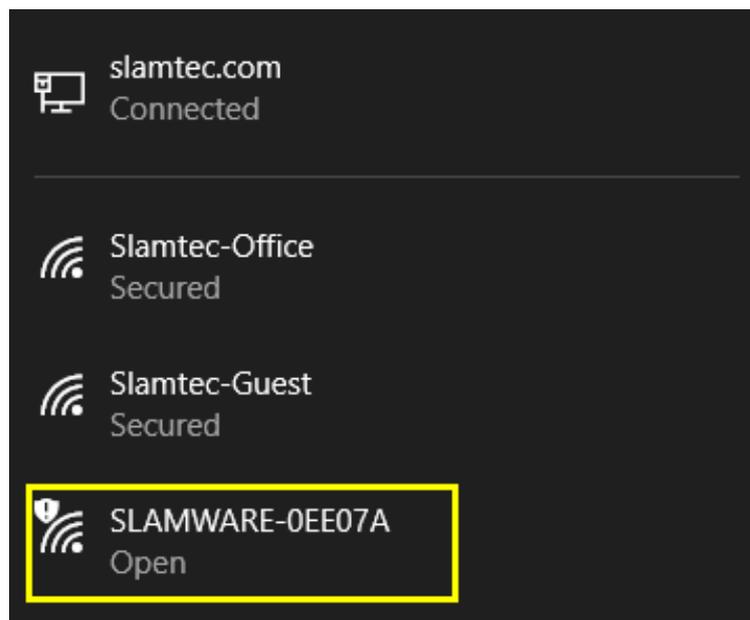


Figure 2.1.2 The SSID hotspot in network adapter

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.

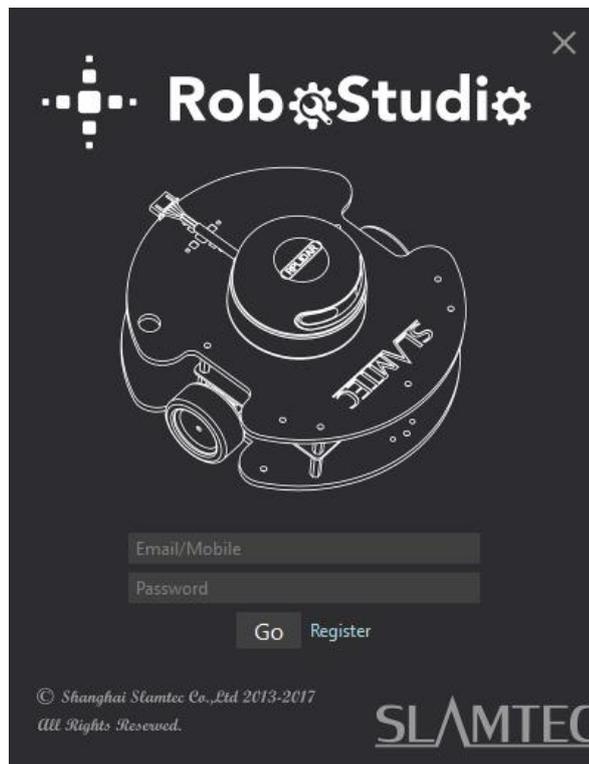


Figure 2.1.3 The login page

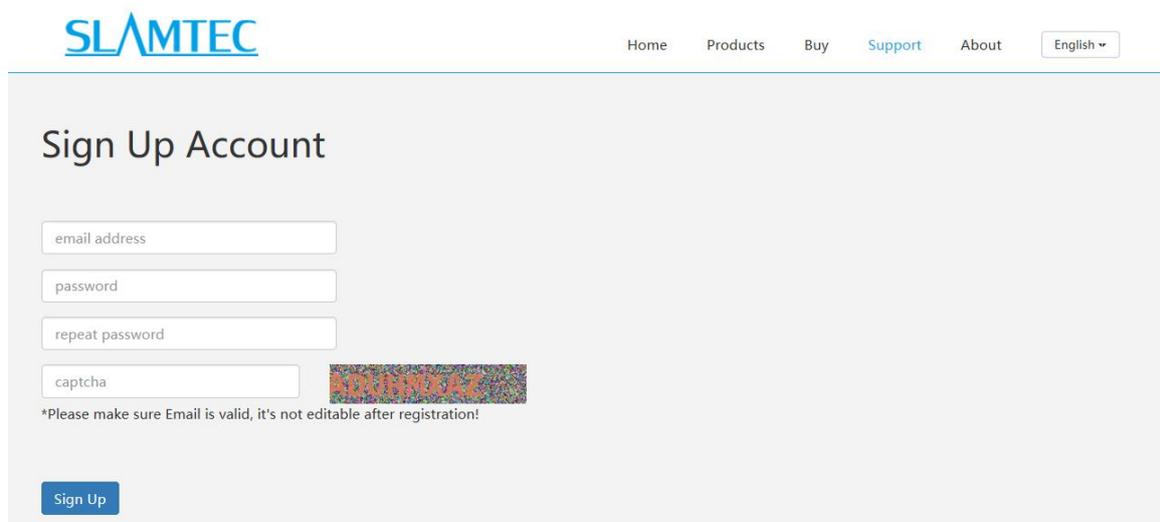


Figure 2.1.4 The register page

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.

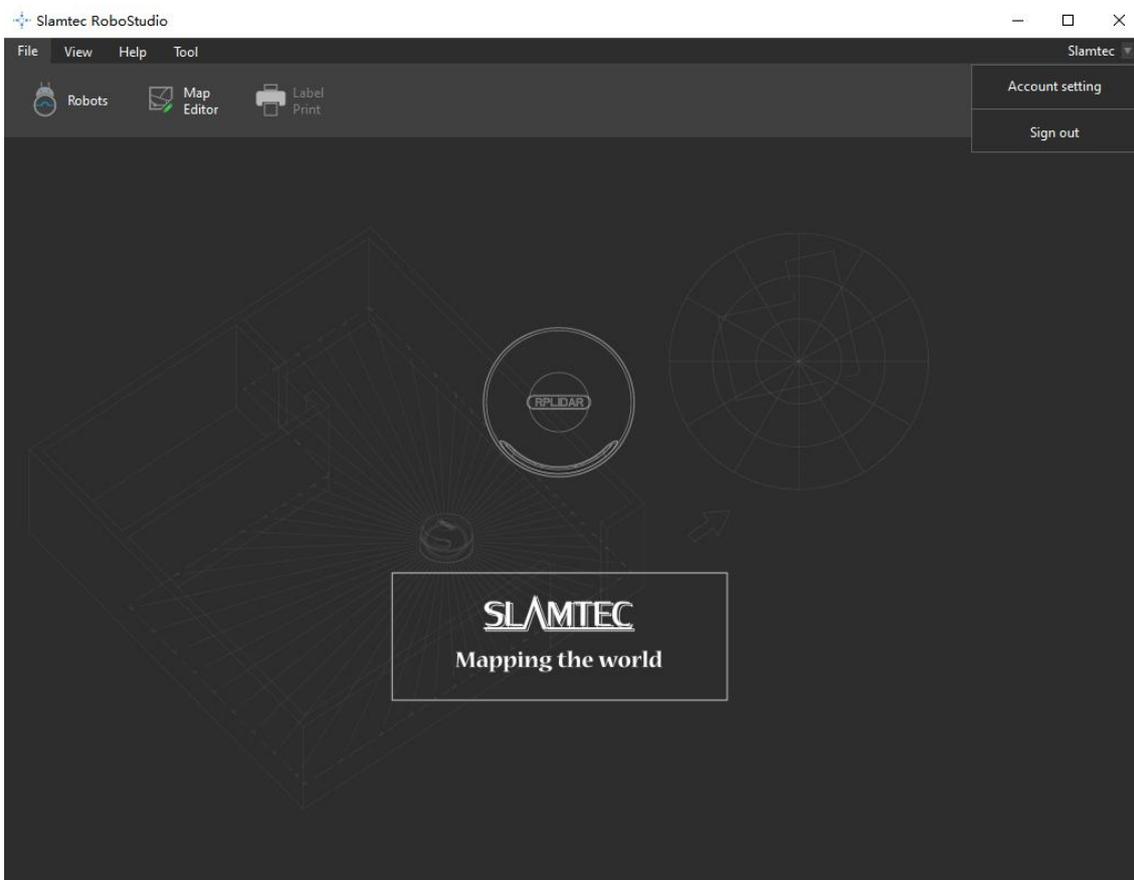


Figure 2.1.5 Major pane

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.

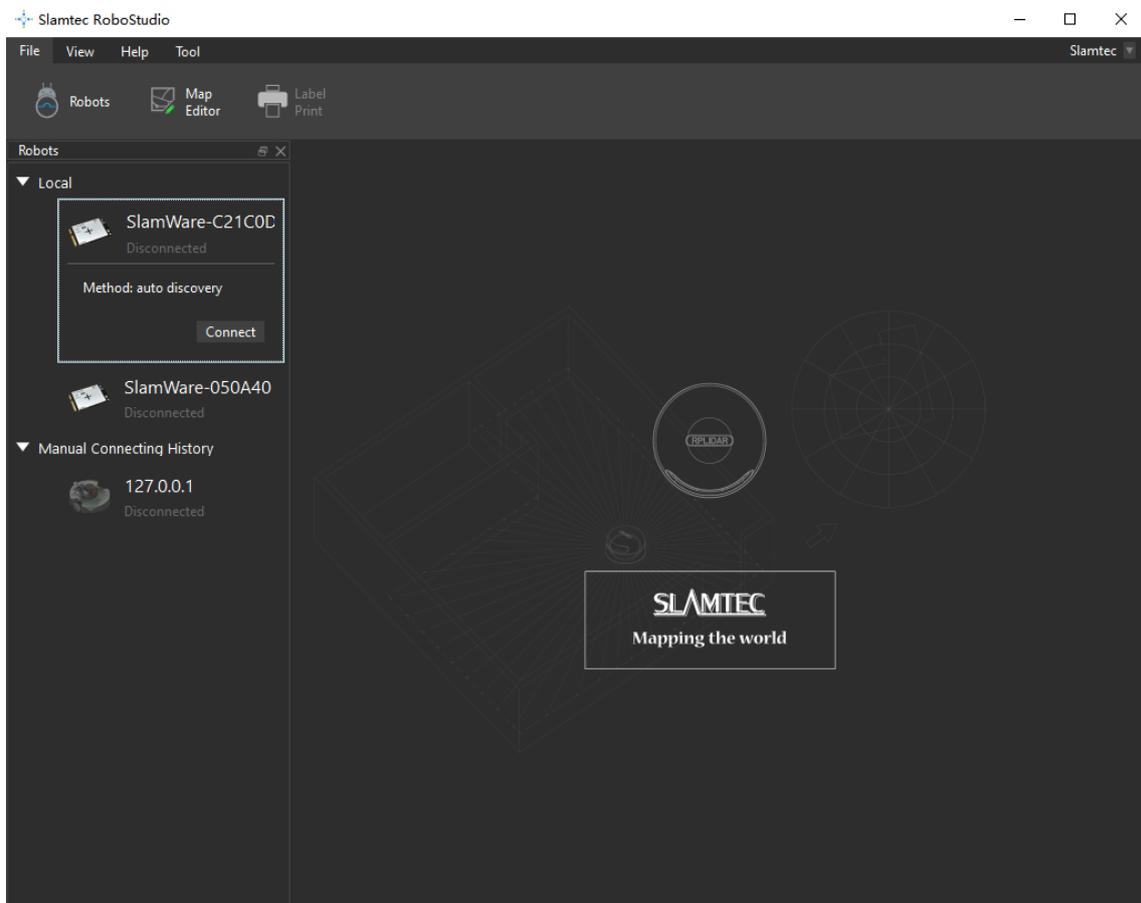


Figure 2.2.1 Docked window

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).

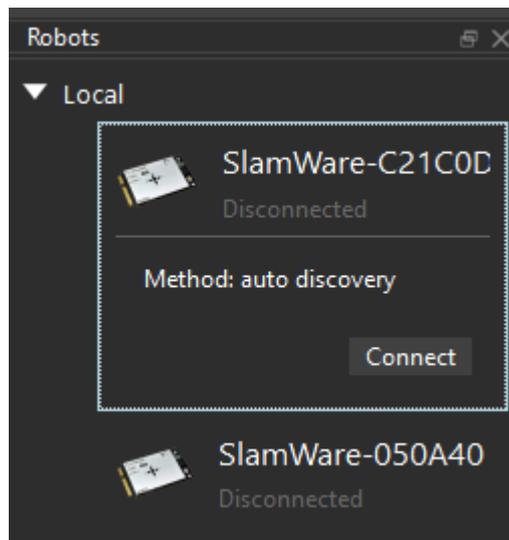


Figure 2.2.2 Connection by Connect button

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)

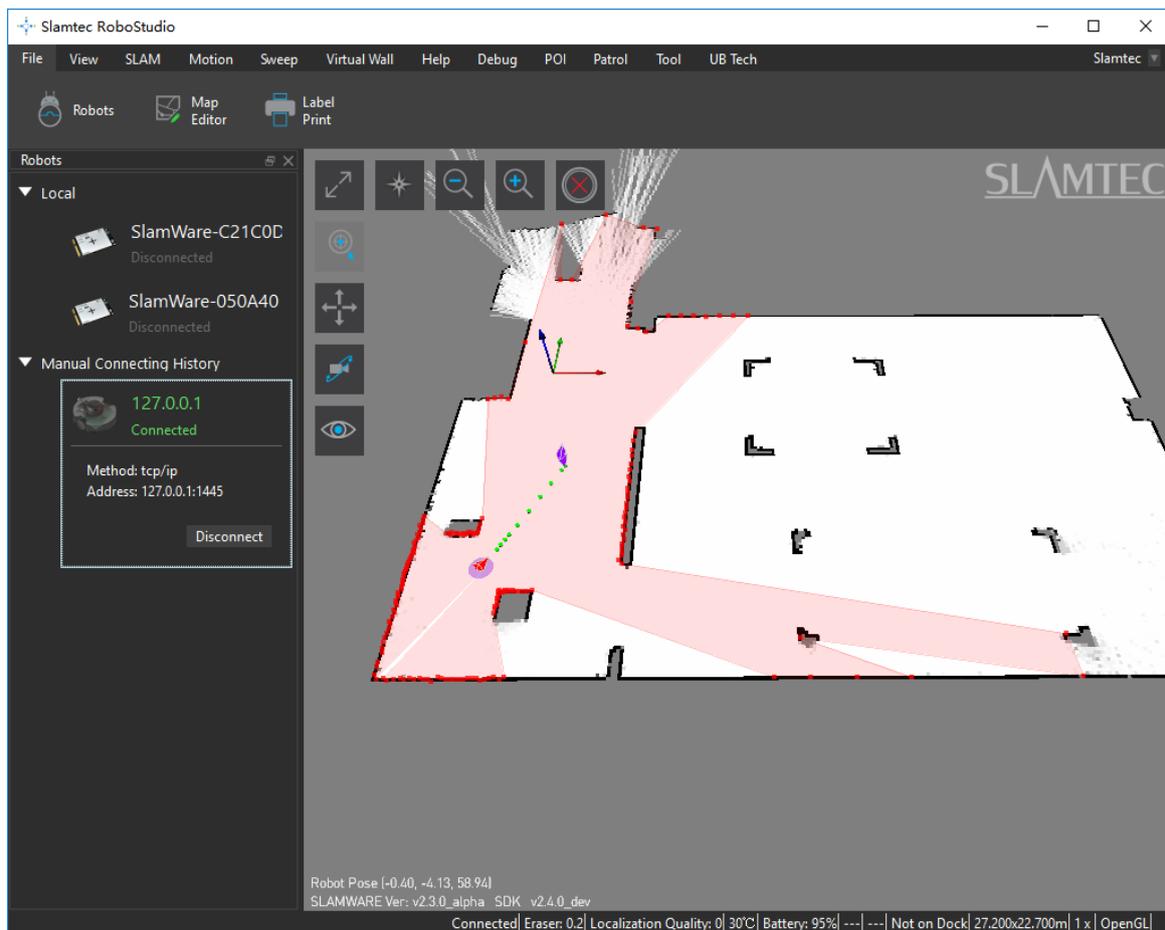


Figure 2.2.4 Successful connection

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 accidentally, 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).

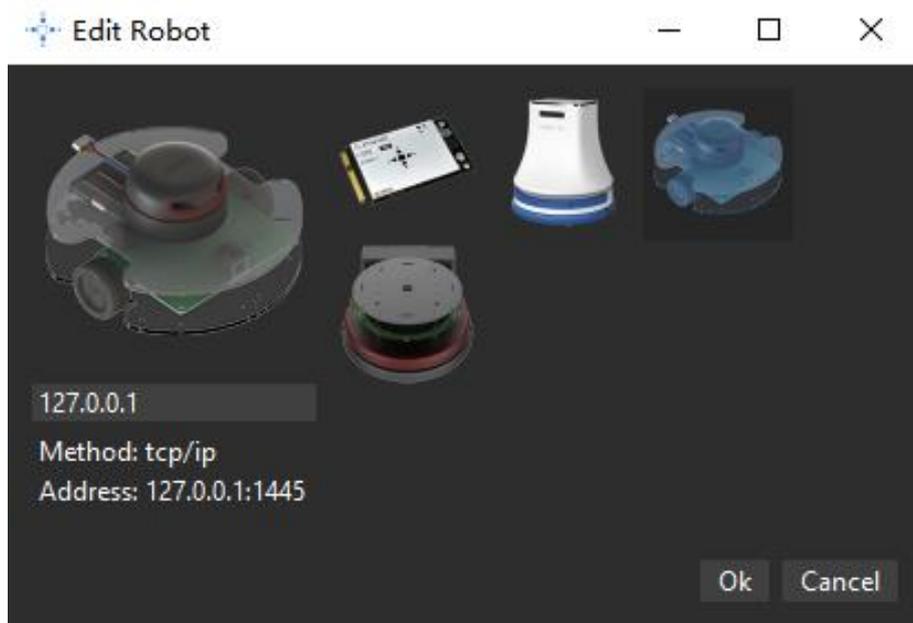


Figure 2.2.5 Edit Robot

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.

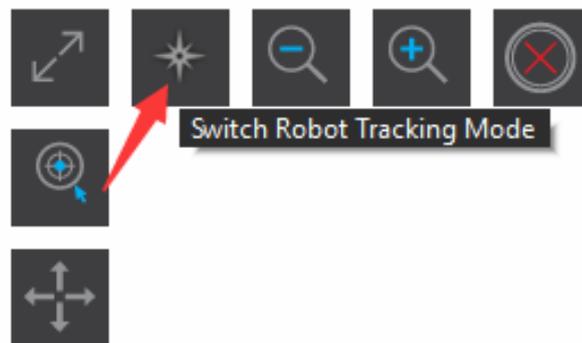


Figure 2.3.1 View Mode Switch

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.

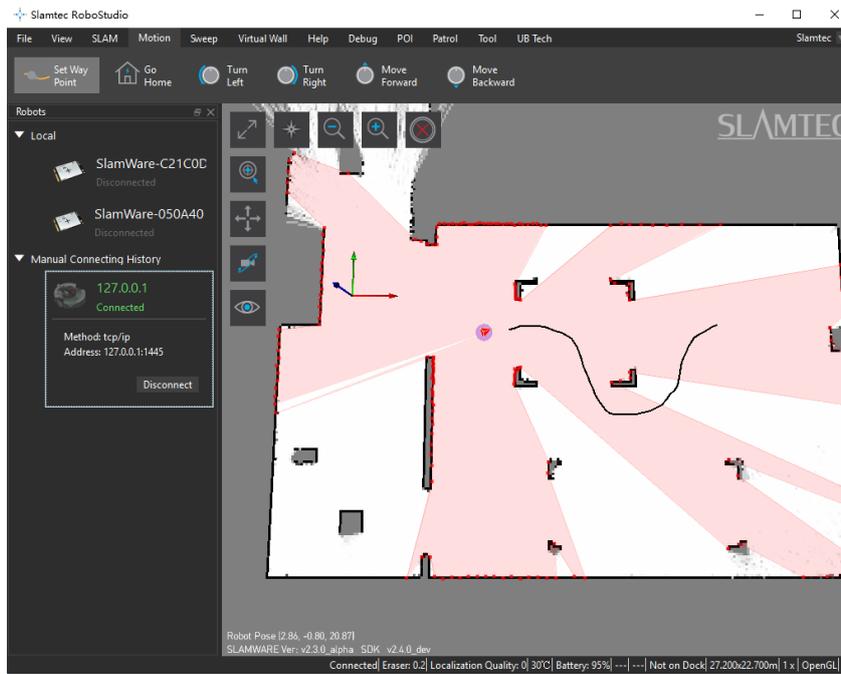


Figure 2.4.1 View Mode Switch

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).

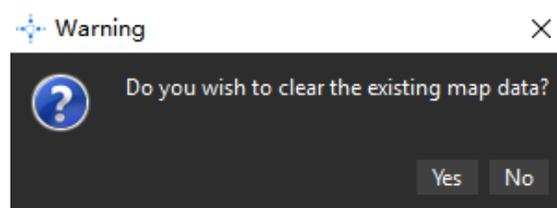


Figure 2.5.1 Clear Map Data

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.

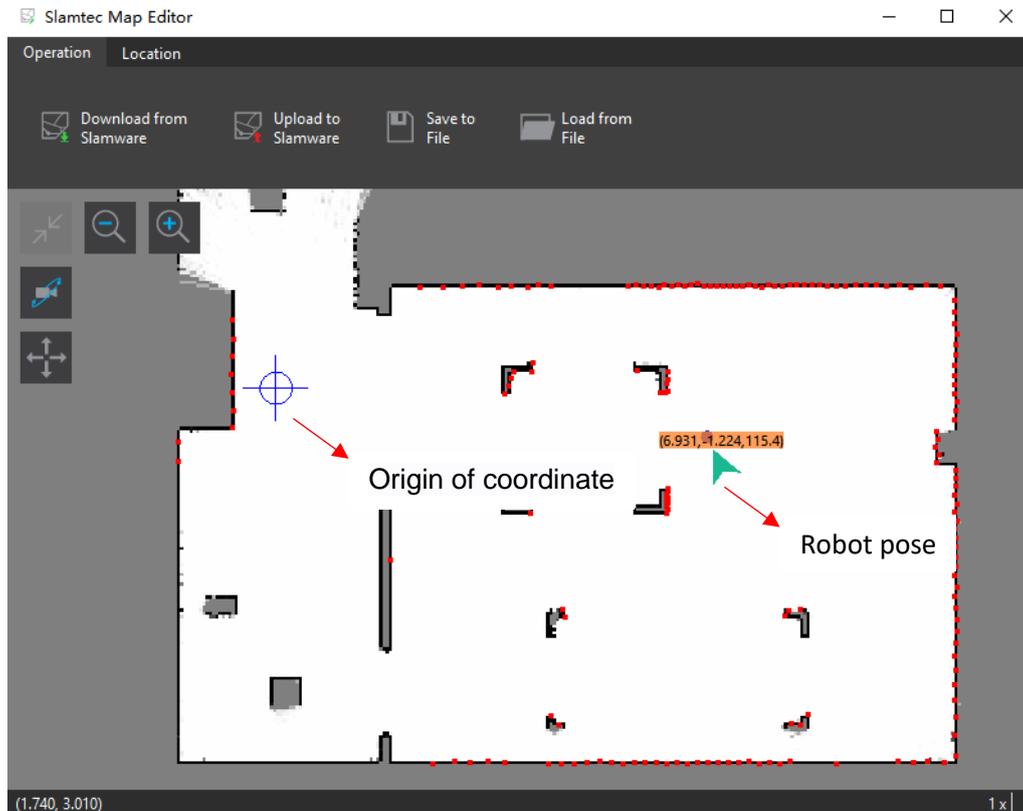


Figure 2.5.2 Map Editor

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 localization 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.

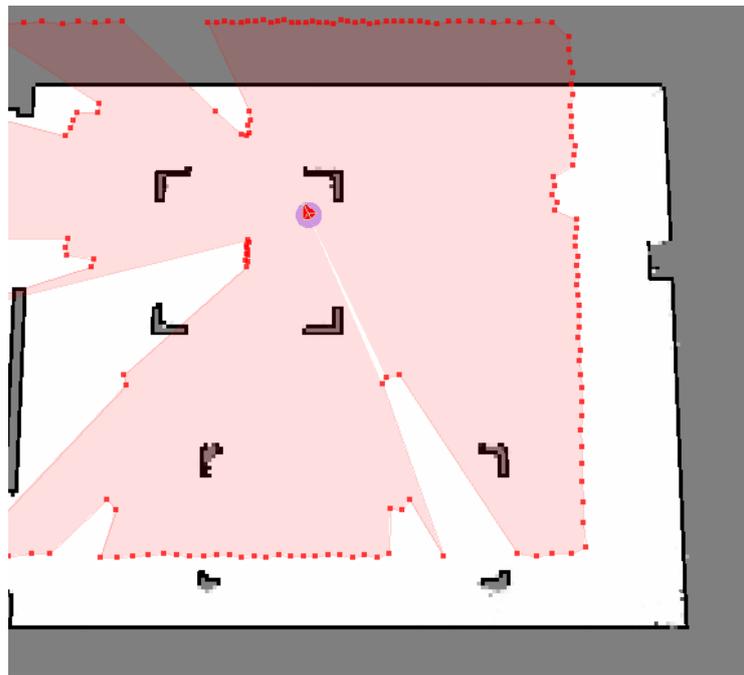


Figure 2.5.3 Localization Deviation

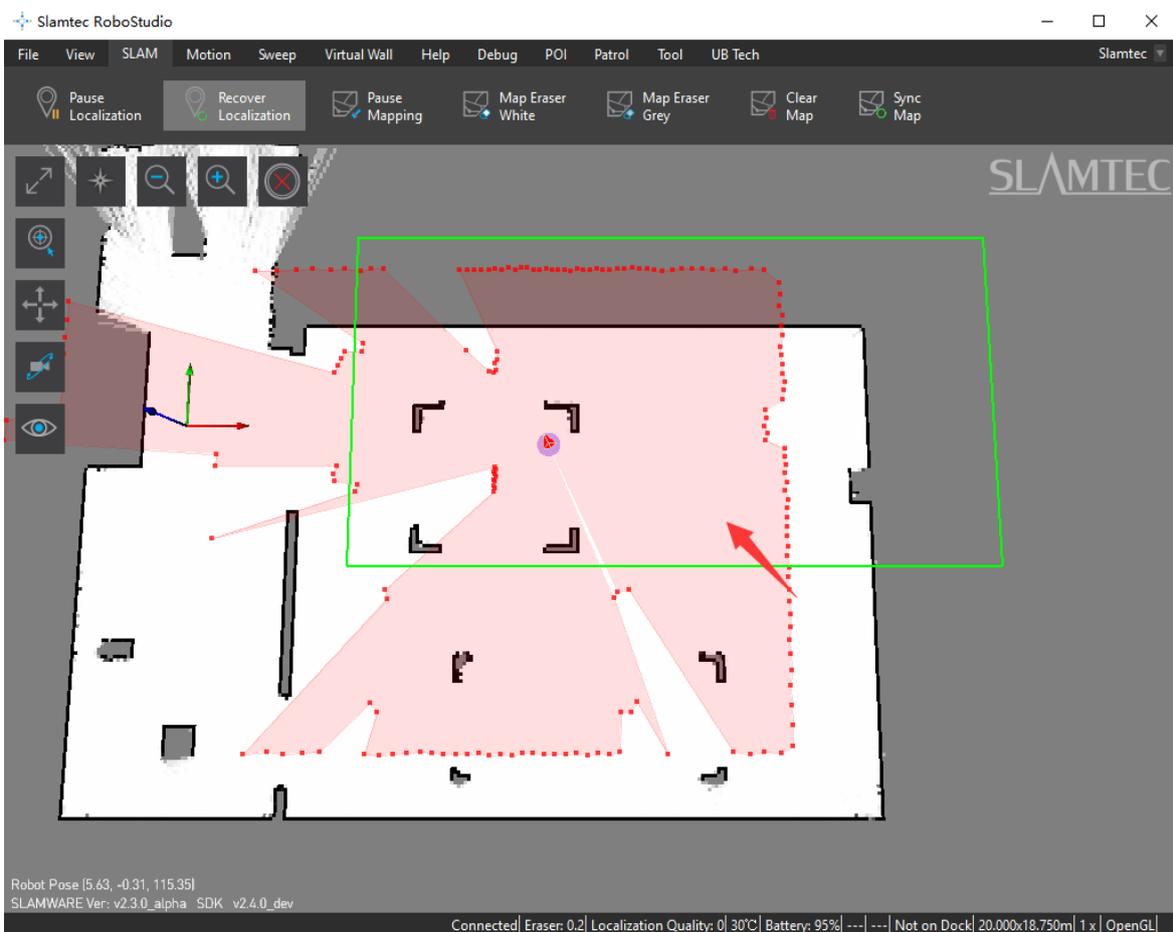


Figure 2.5.4 Select efficient area

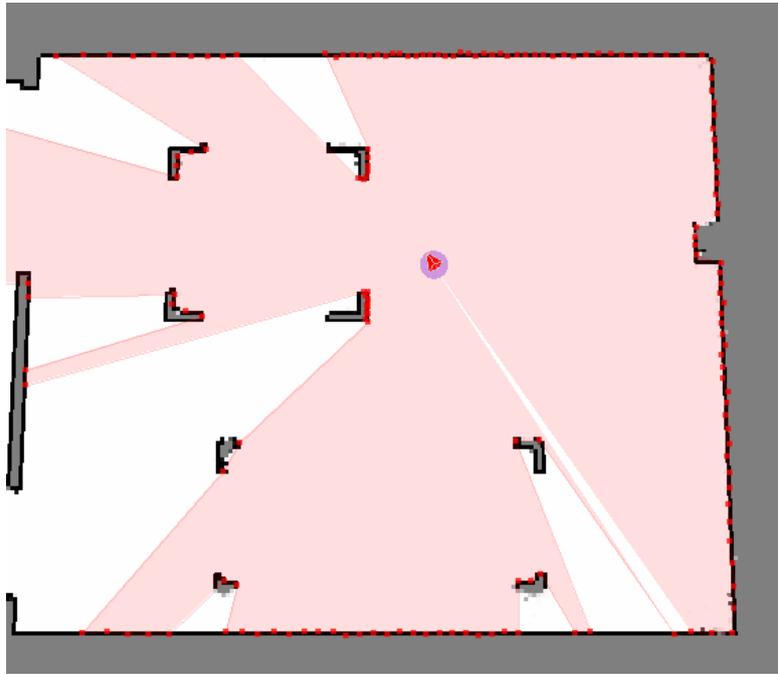


Figure 2.5.5 Localization recovered

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.

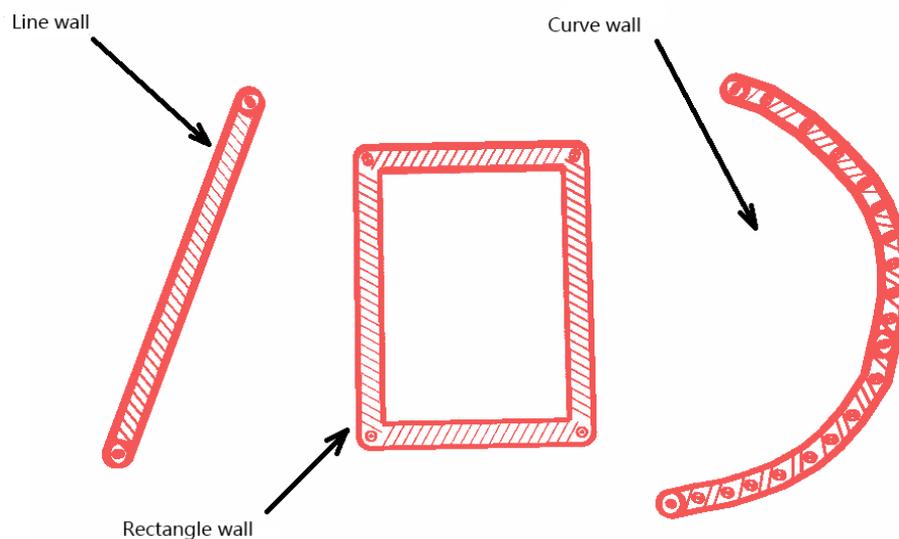


Figure 2.6.1 Different Virtual Walls

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.

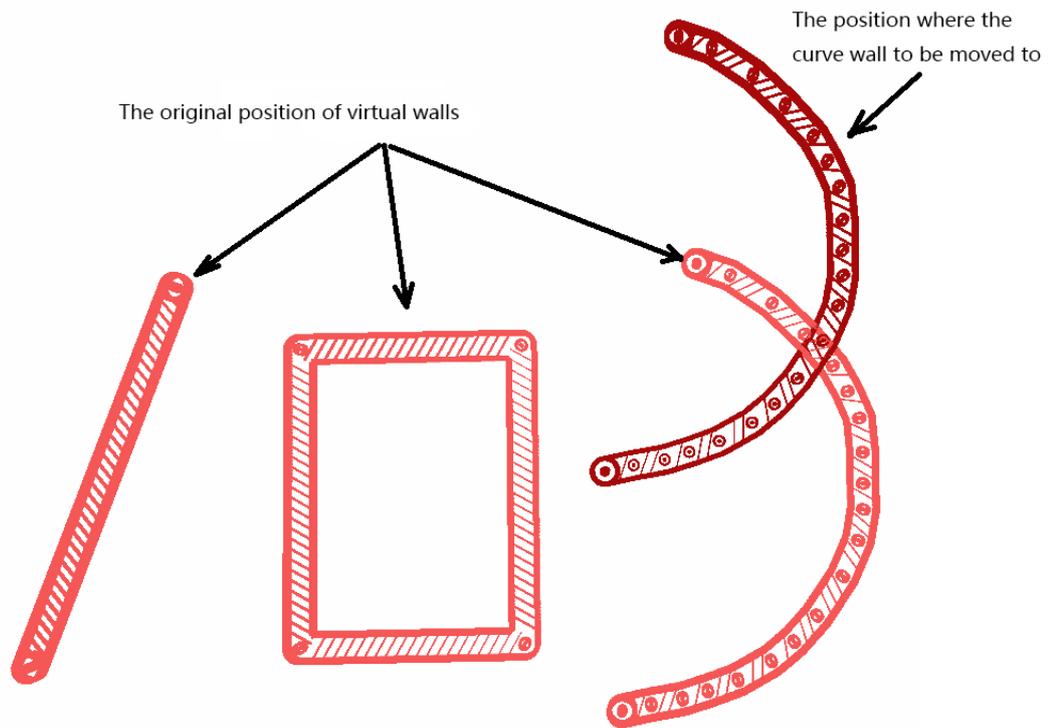


Figure 2.6.2 Drag the virtual wall to a new place

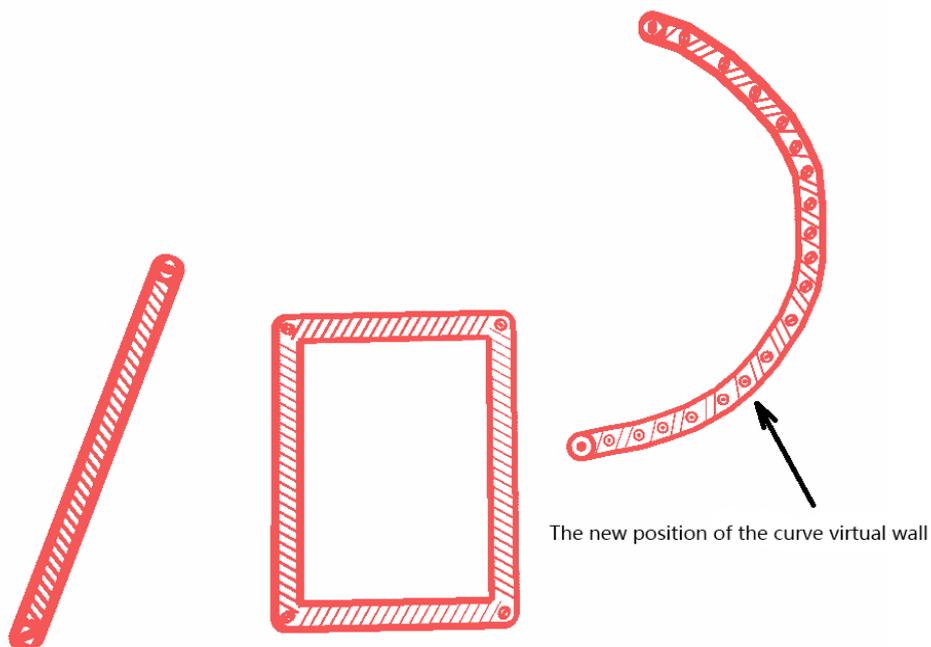


Figure 2.6.3 The virtual wall has moved to a new place

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.

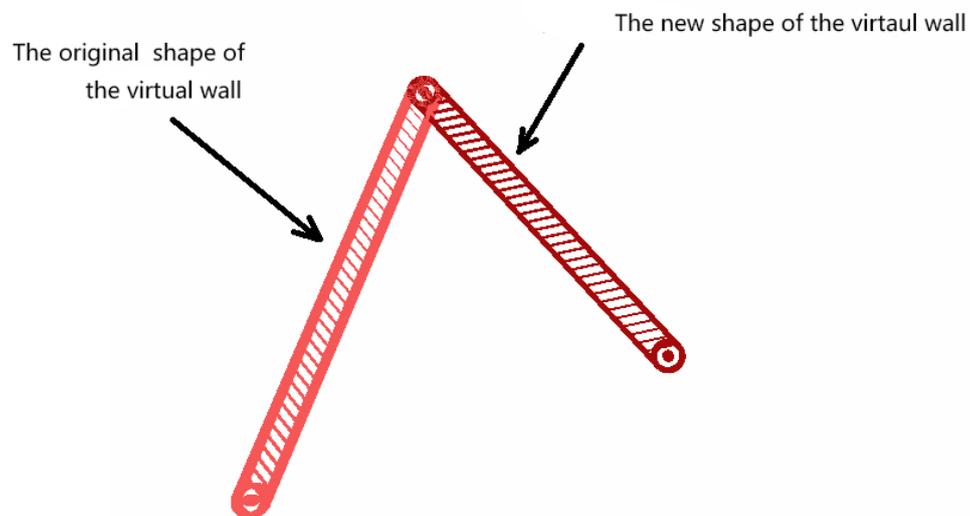


Figure 2.6.4 Choose the virtual wall and drag its endpoint

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.

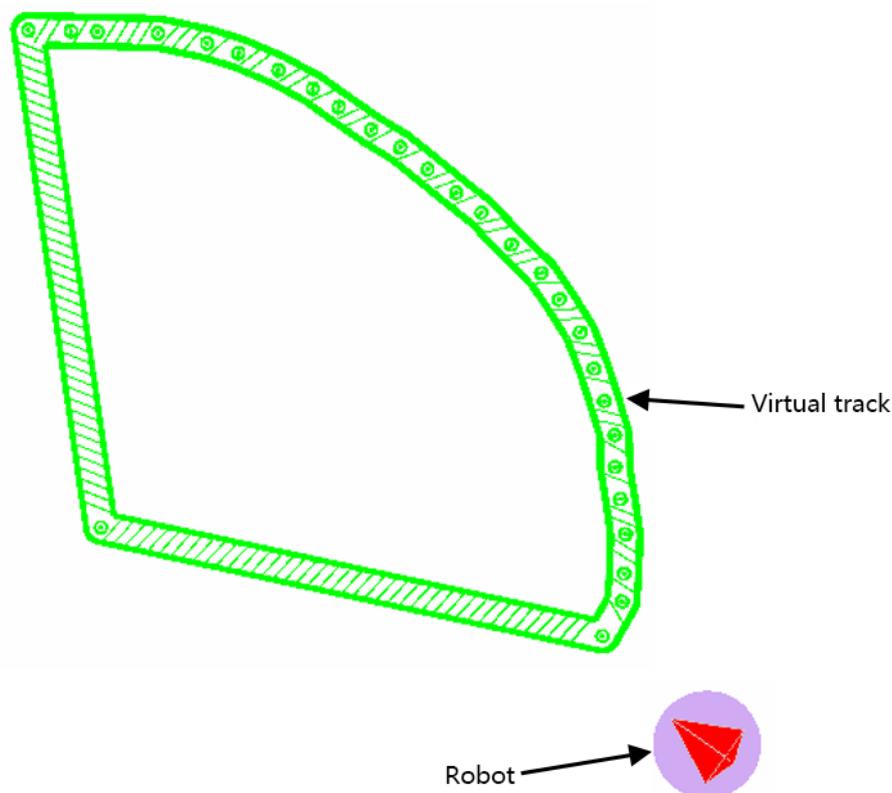


Figure 2.7.1 Virtual Track

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.

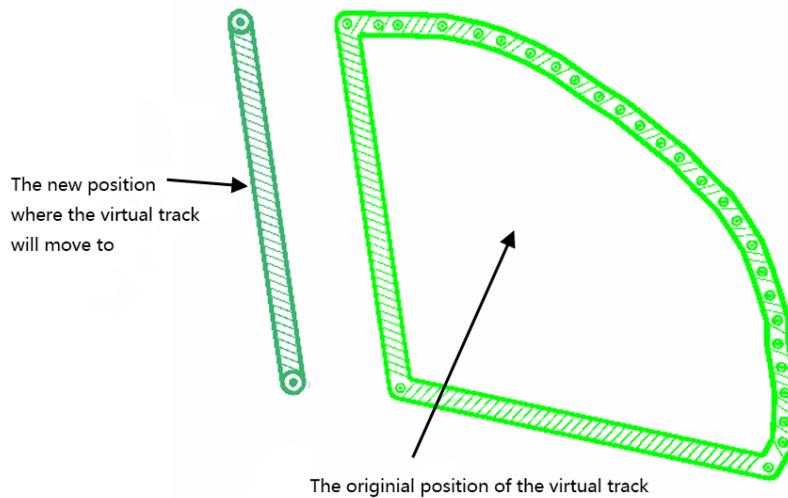


Figure 2.7.2 Choose and drag a virtual track

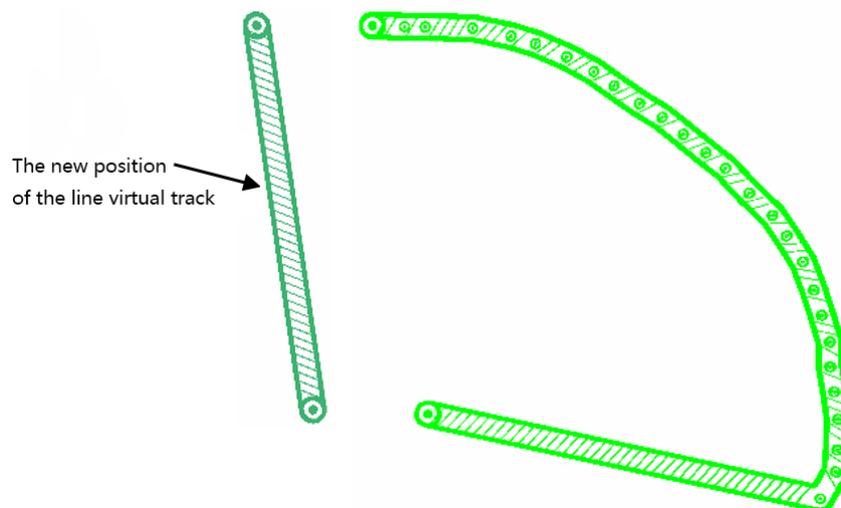


Figure 2.7.3 The virtual track has moved to a new place

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.

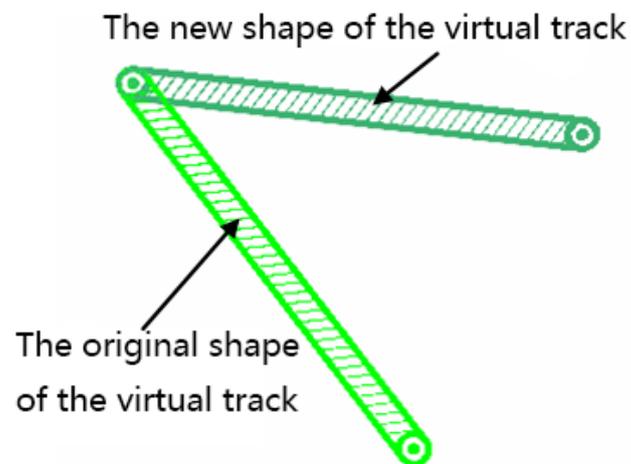


Figure 2.7.4 Localization recovered

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.

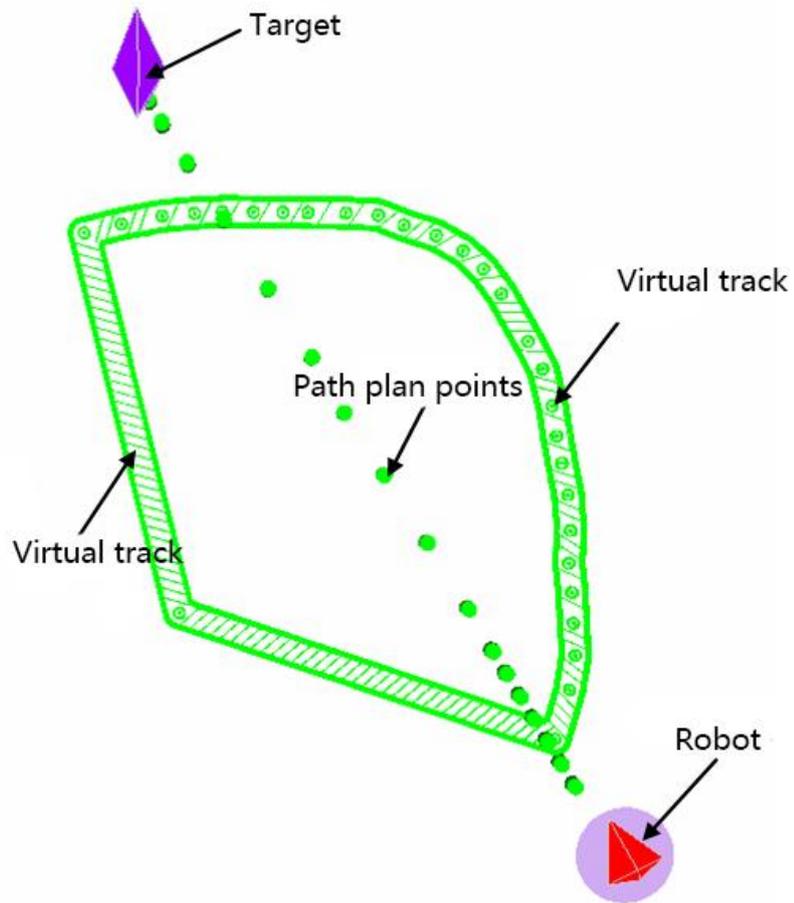


Figure 2.7.5 Path finding in normal navigation mode

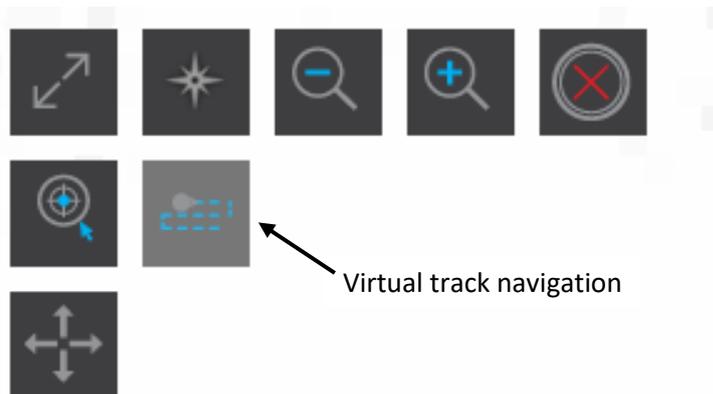


Figure 2.7.6 Virtual track navigation button

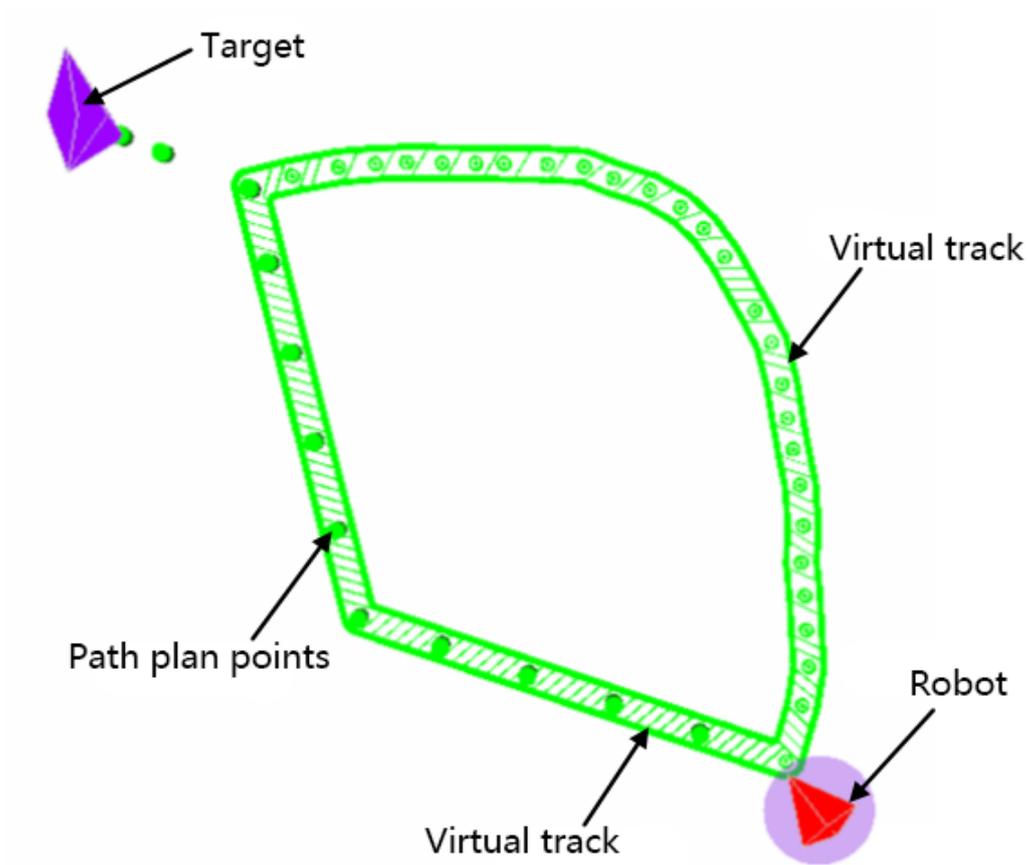


Figure 2.7.7 Path finding in virtual track navigation mode

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.

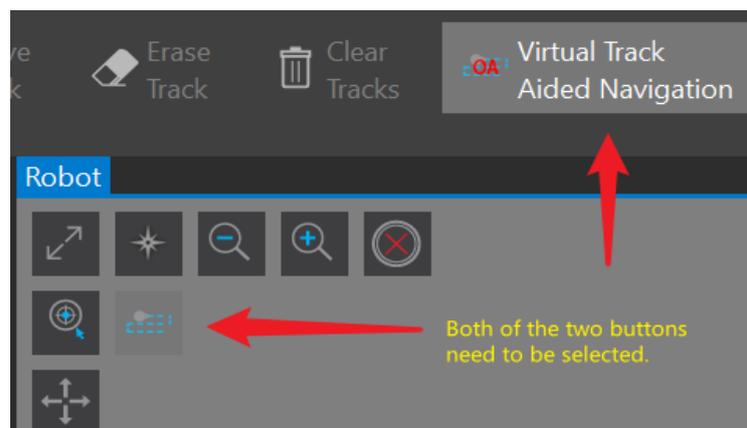


Figure 2.7.8 Virtual Track Aided Navigation button

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.

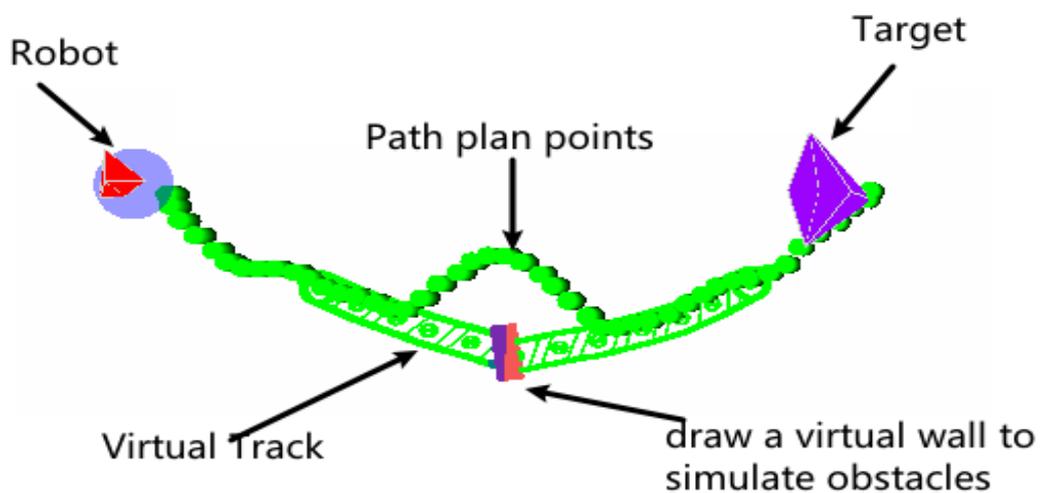


Figure 2.7.9 Path finding in virtual track aided navigation mode

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.

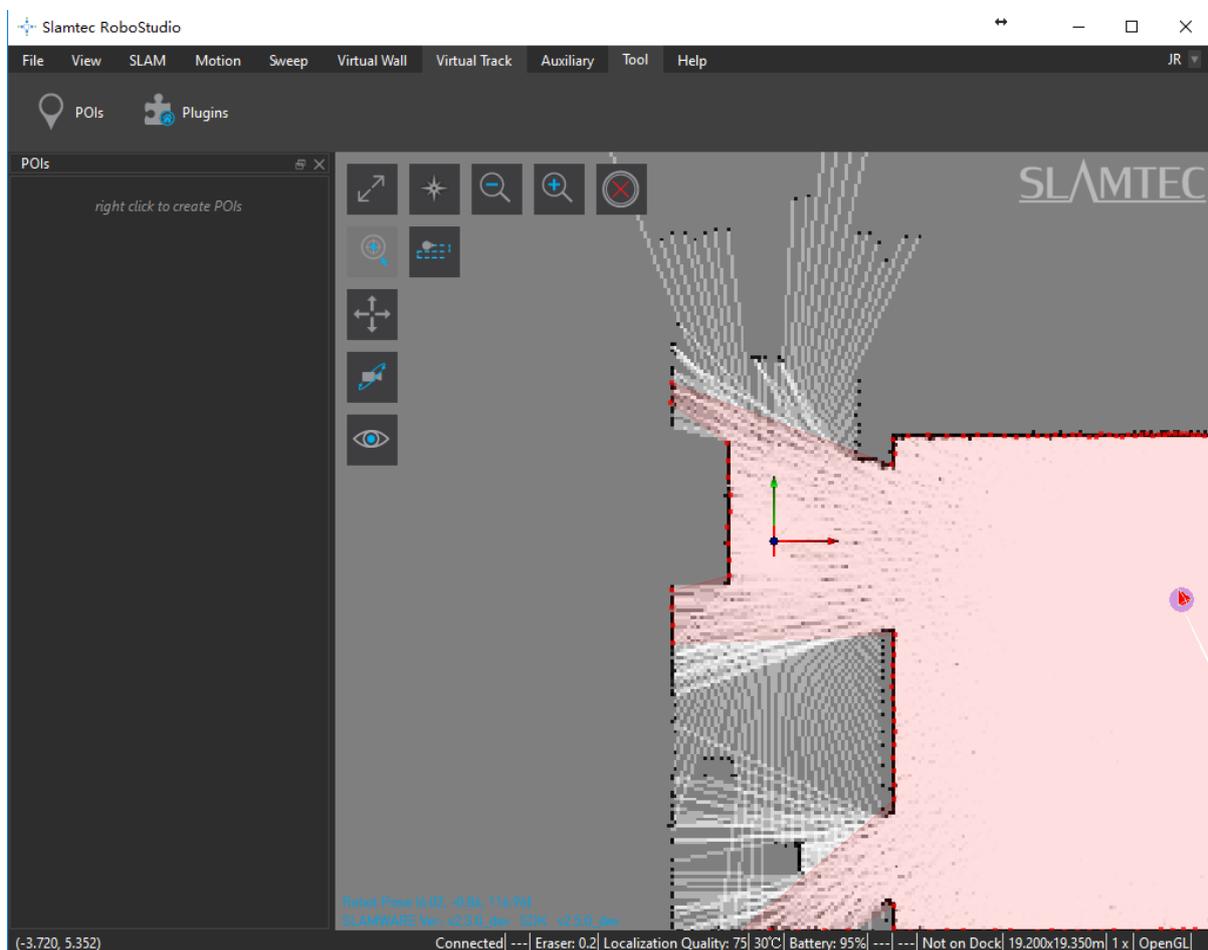


Figure 2.8.1 POI Management List

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.

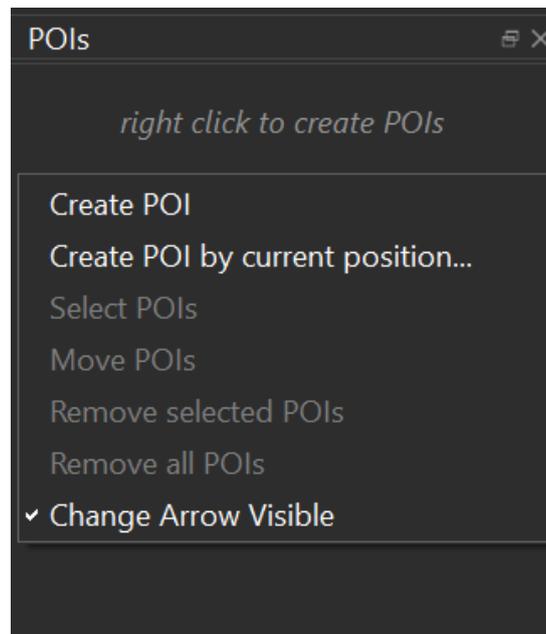


Figure 2.8.2 Right-click Menu In The White Space Of POIs list

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.

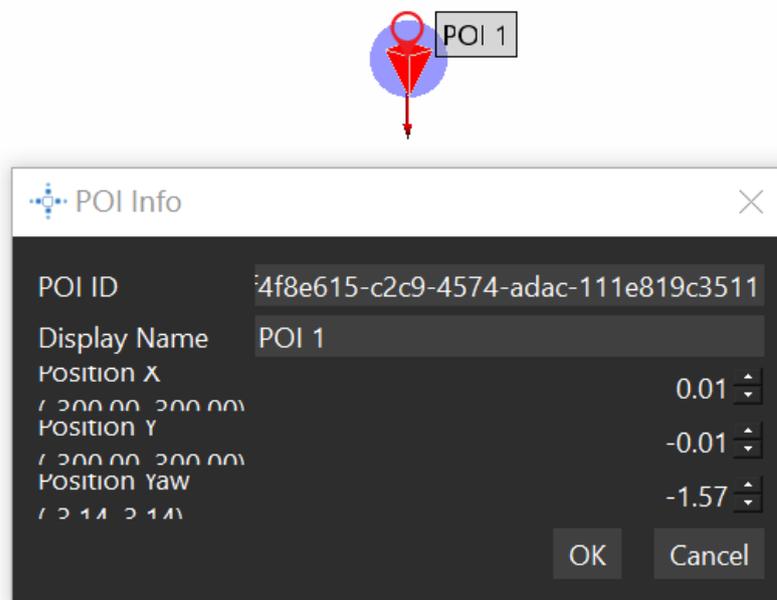


Figure 2.8.3 POI Info Dialog Box

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.

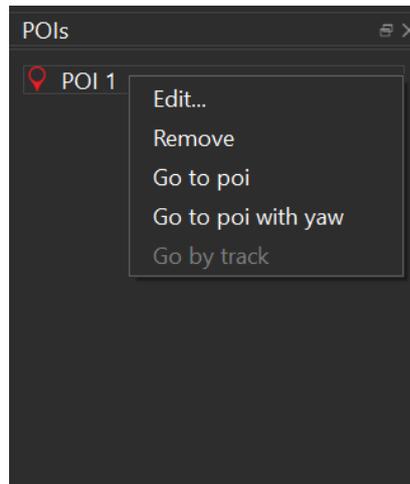


Figure 2.8.4 Right-click Menu In POIs

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 a 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 a 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.

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.

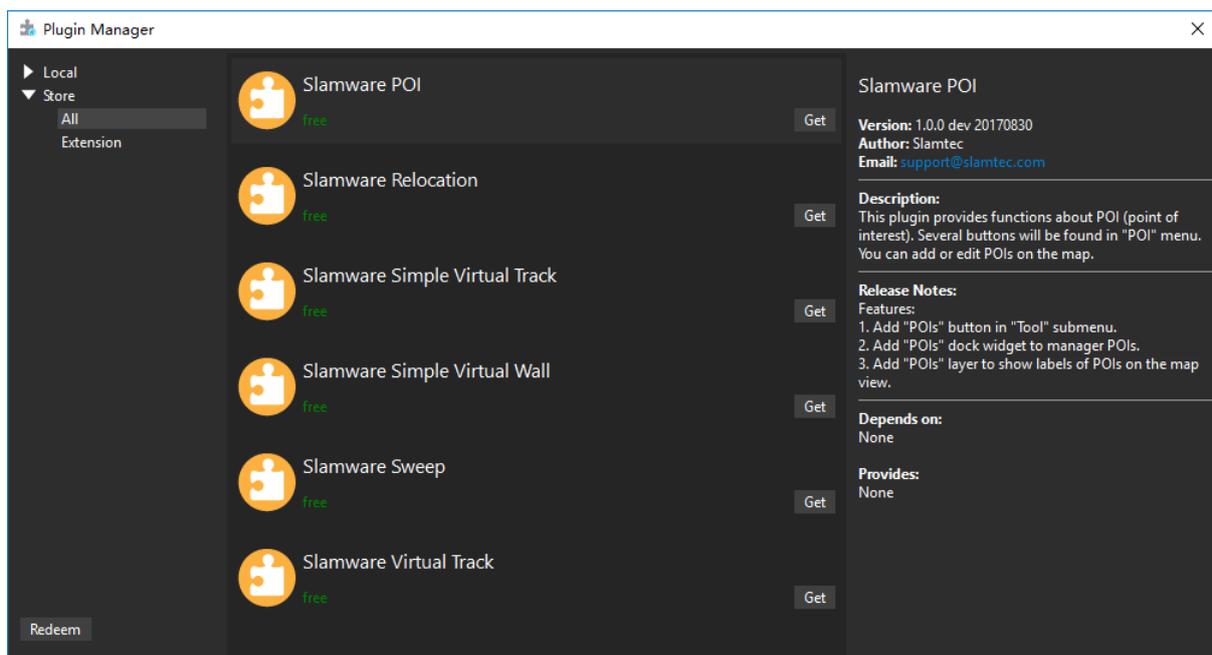


Figure 2.9.1 Plugin Manager Dialog Box

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.

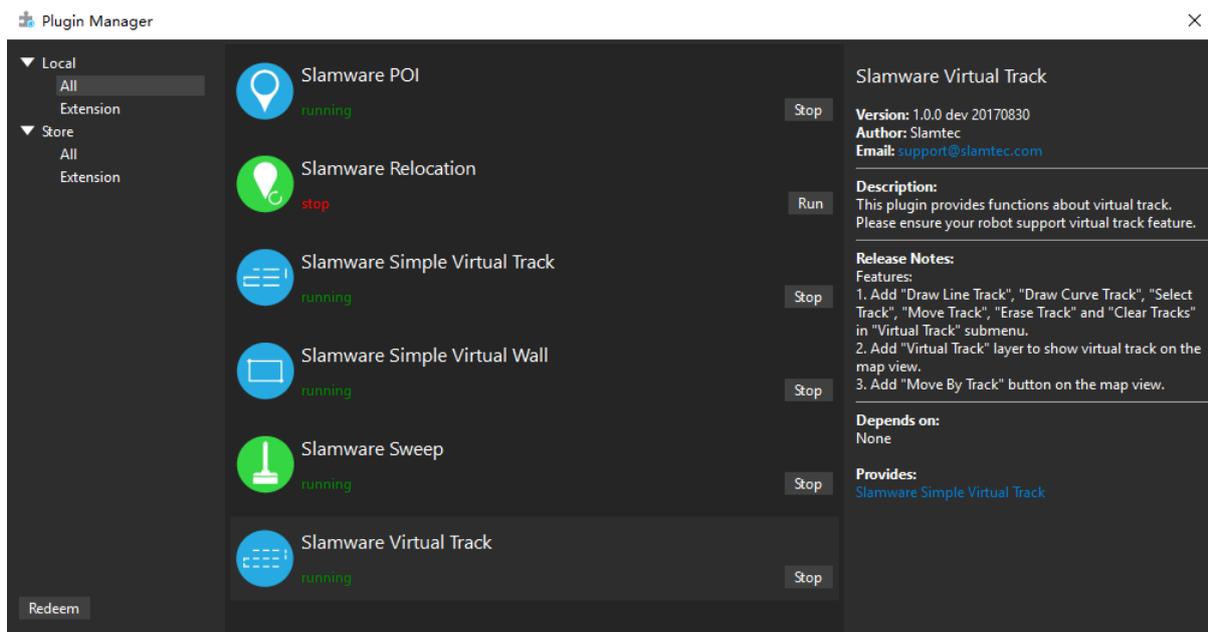


Figure 2.9.2 Local Plugin Management

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.

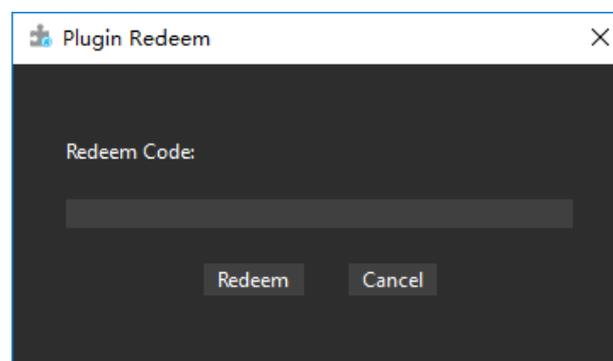


Figure 2.9.3 Plugin Redeem Dialog

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**.

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

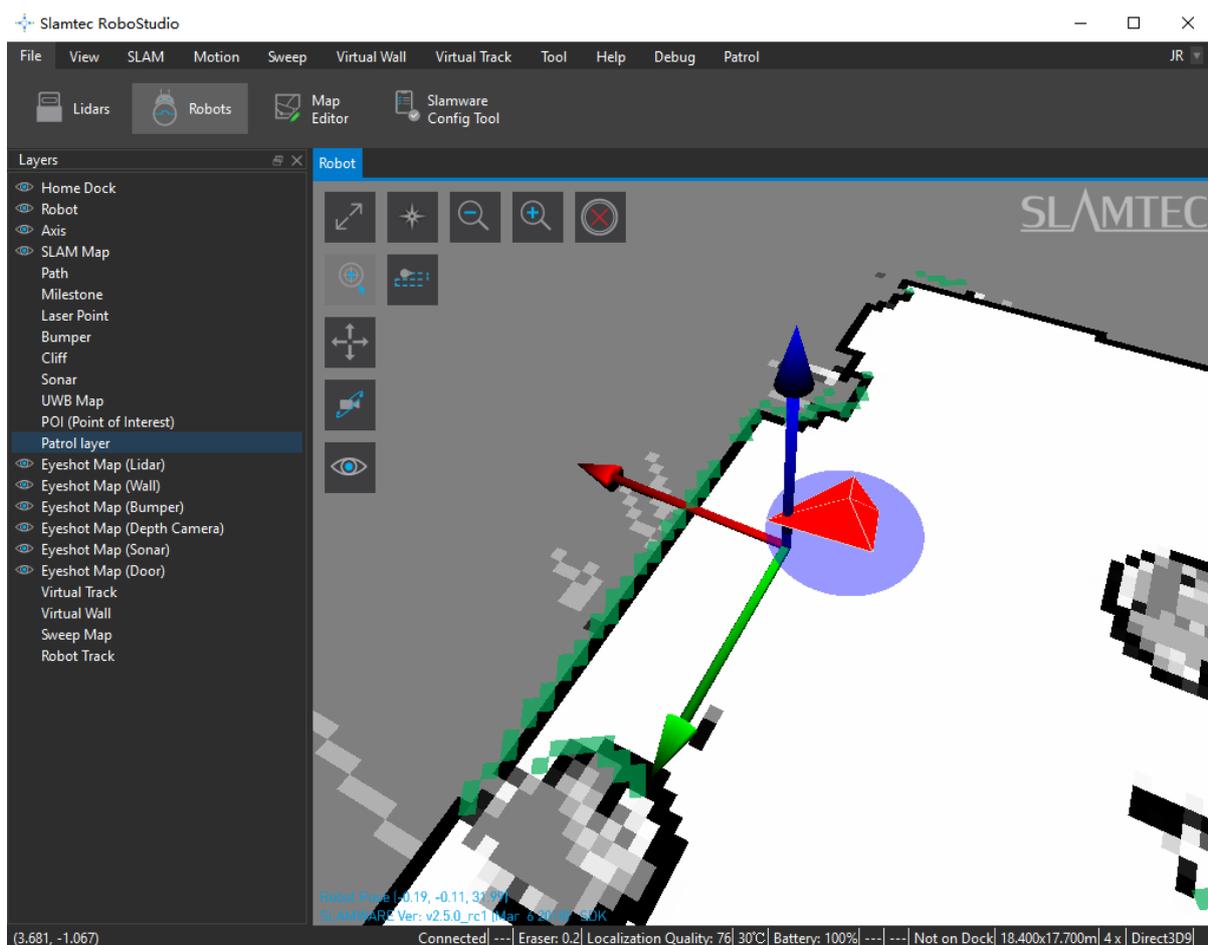


Figure 2.11.1 Slamware Config Tool Dialog

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.

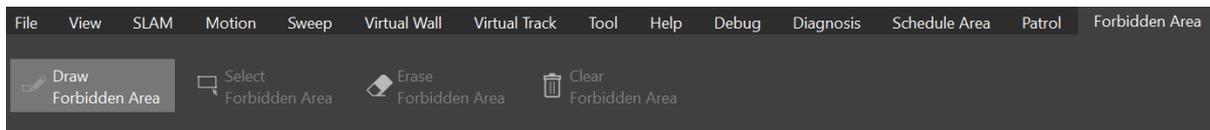


Figure 2.12.1 The toolbar of Forbidden Area

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.

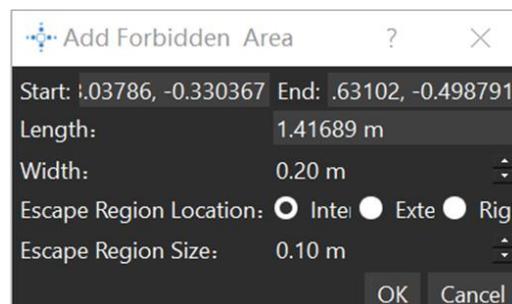


Figure 2.12.2 Add Forbidden Area Dialog

1) Description 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.

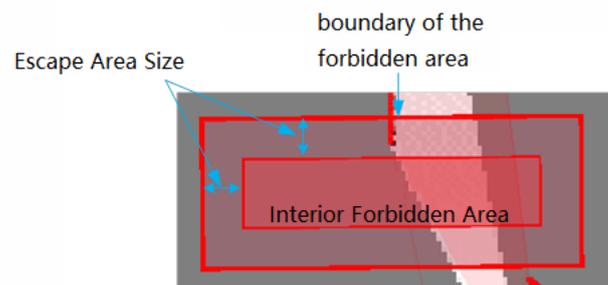


Figure 2.12.3 Escape Region Size

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.

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

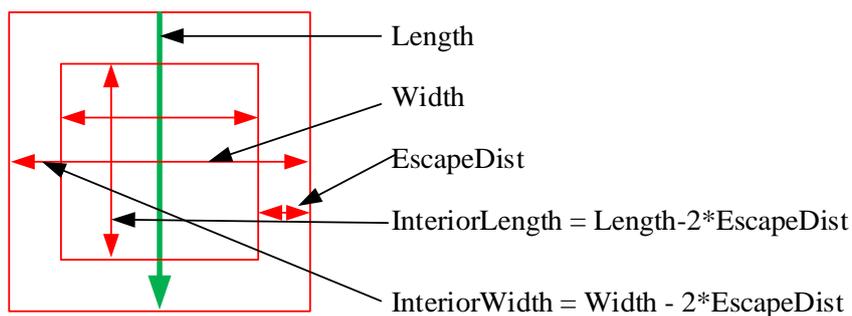


Figure 2.12.4 Set up forbidden area inward

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.

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

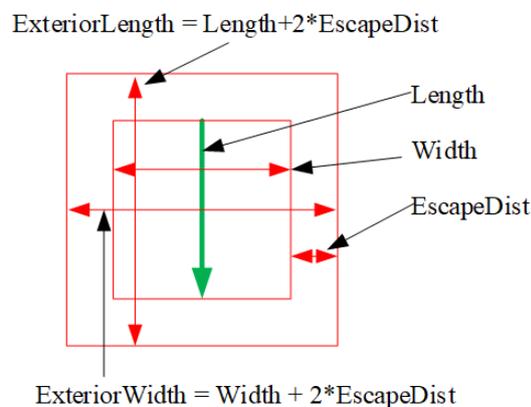


Figure 2.12.5 Set up forbidden area outward

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.

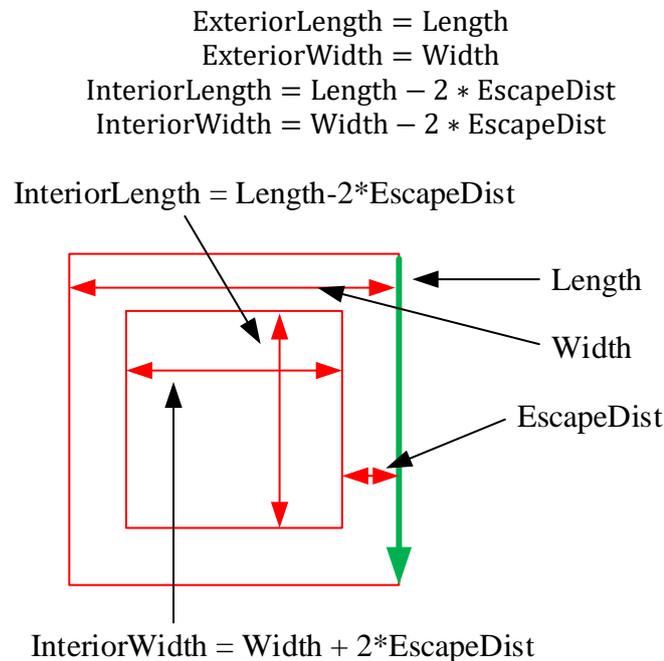


Figure 2.12.6 Set up forbidden area towards the right

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.

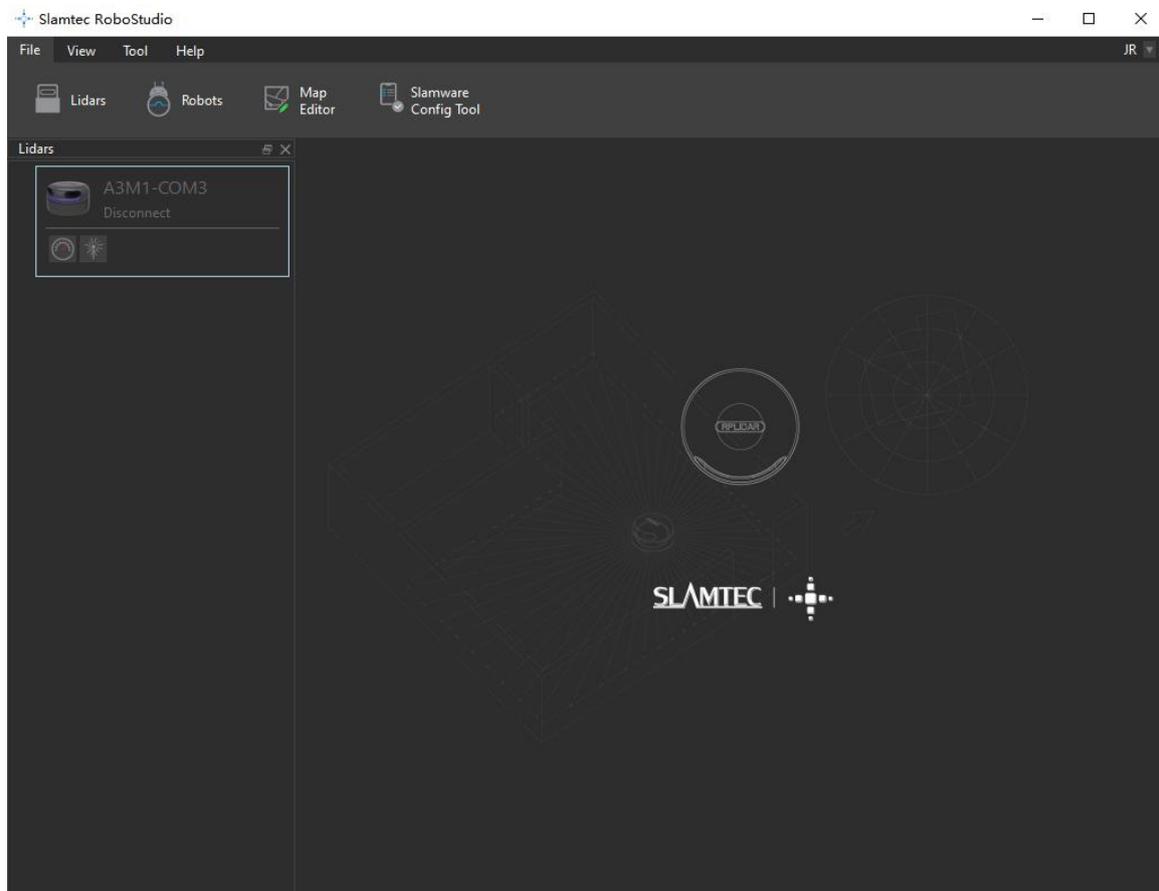


Figure 2.13.1 Lidars Management Panel

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.

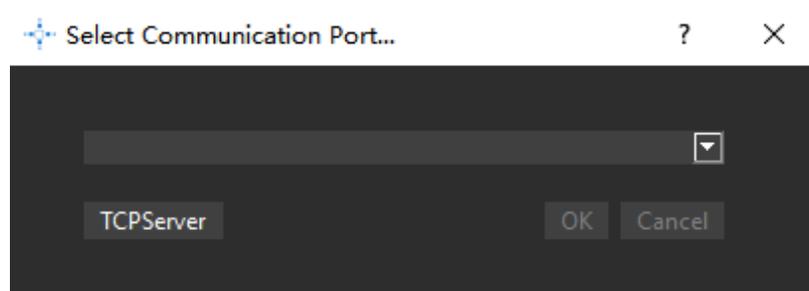


Figure 2.13.2 Manually Select Port for Lidars Connection

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.

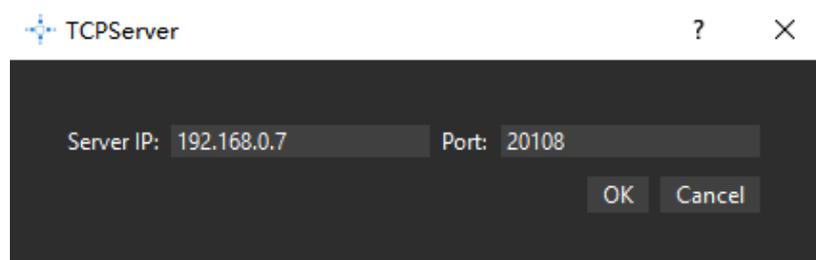


Figure 2.13.3 TCP Server for Lidars Connection

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.

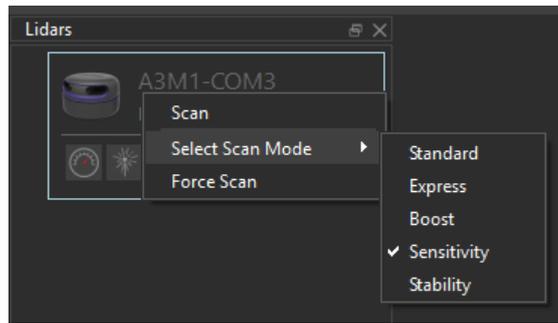


Figure 2.13.4 Scan Mode Selection

Start Scan

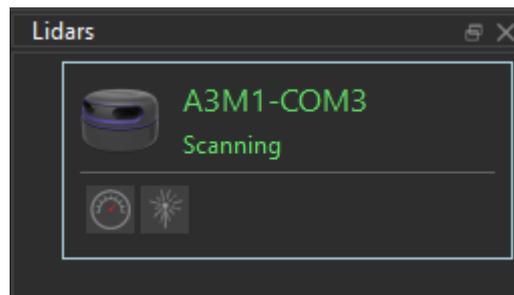


Figure 2.13.5 Lidars Panel

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

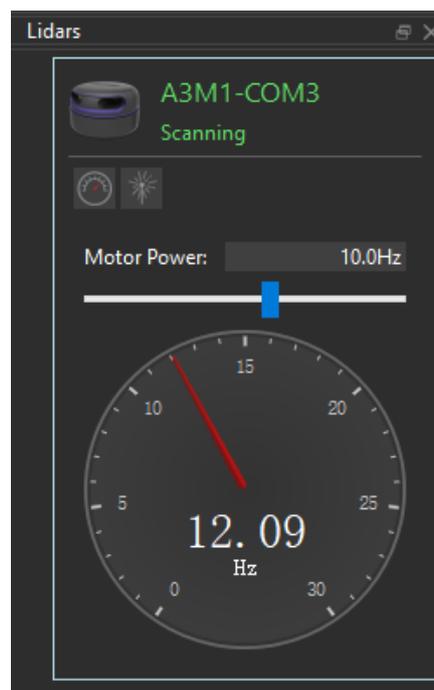


Figure 2.13.6 Motor Speed Adjustment Dash Board

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.

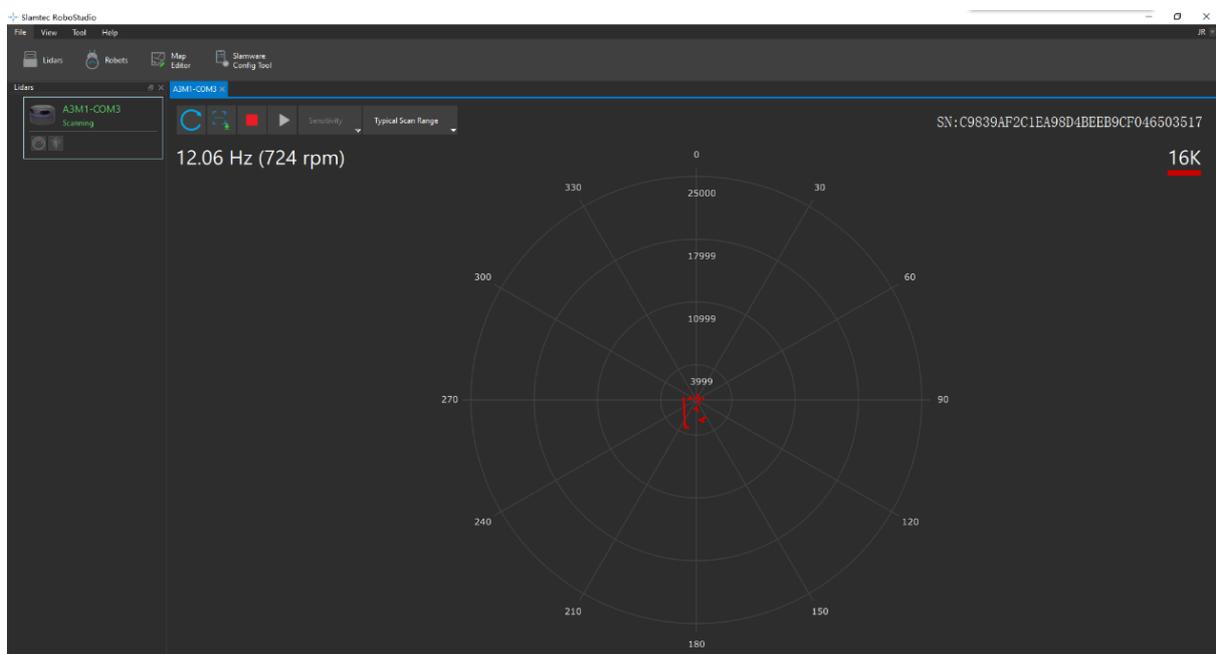


Figure 2.13.7 Scan Observation Window

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.

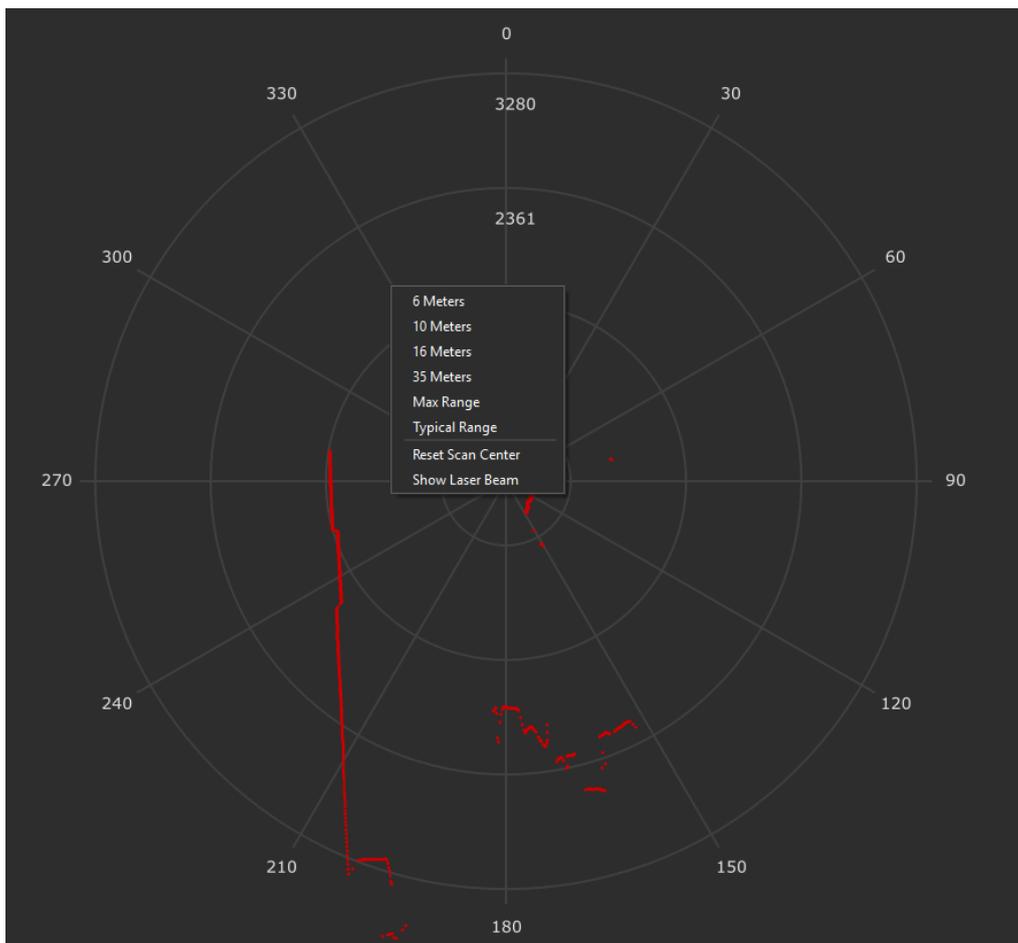


Figure 2.13.9 Context Menu in Scan Mode

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.

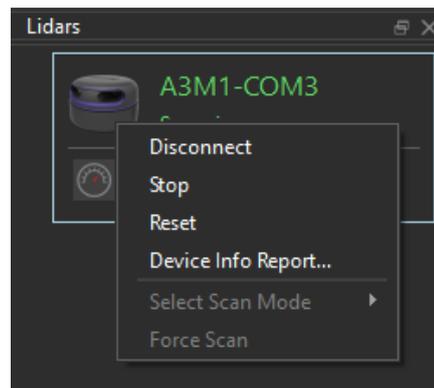


Figure 2.13.10 Context Menu in Scan Mode

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.

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.
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 Navigation		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		Remove 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 Navigation chapter; 2. Updated the POI Management chapter; 3. Added Forbidden Area Management chapter; 4. Added Virtual Track Aided Navigation and Forbidden Area buttons icons in Figure 3.1.1 Menu Bar Function List

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