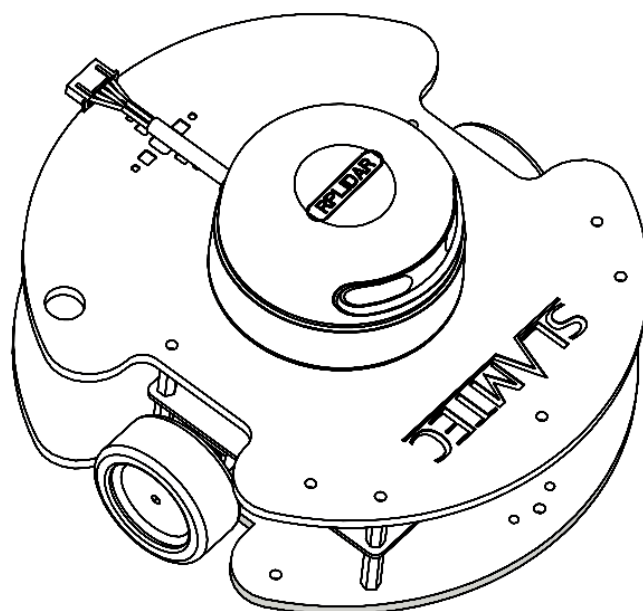


SLAMWARE

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 **Offline Mode** in Figure 2.1.1 to enter offline mode.

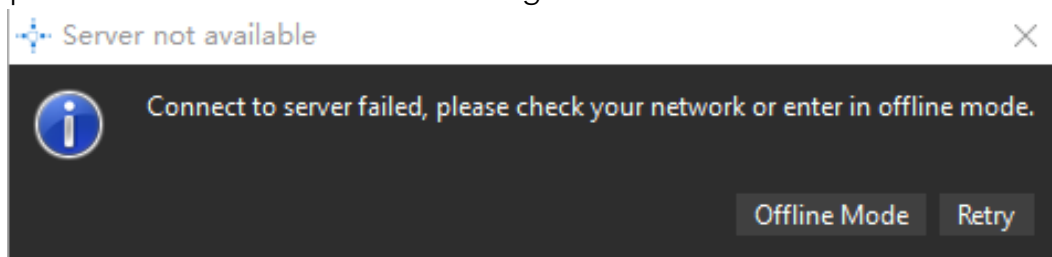


Figure 2.1.1 The prompt dialog box after launching offline

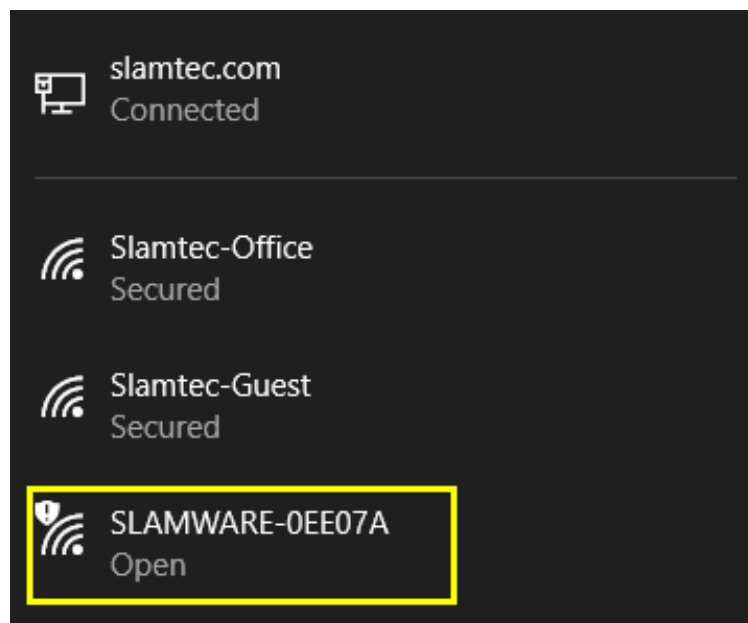


Figure 2.1.2 The SSID hotspot in network adapter

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.

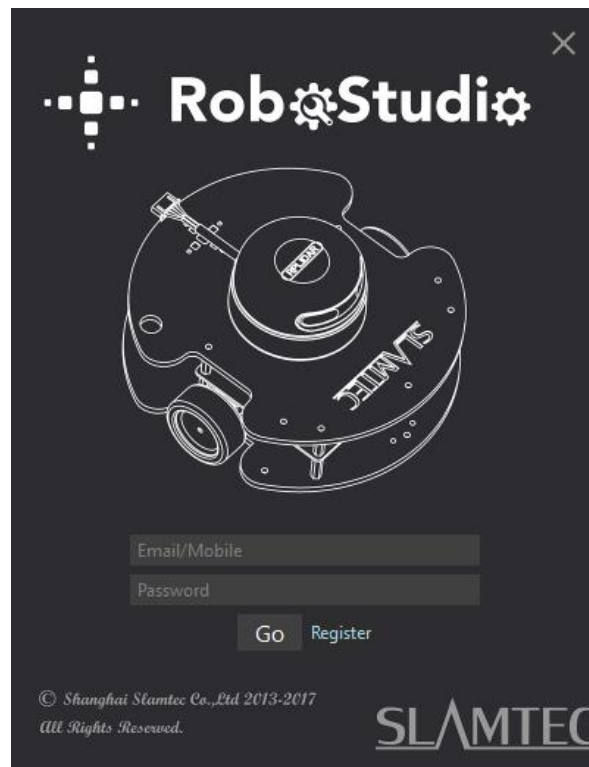


Figure 2.1.3 The login page

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.

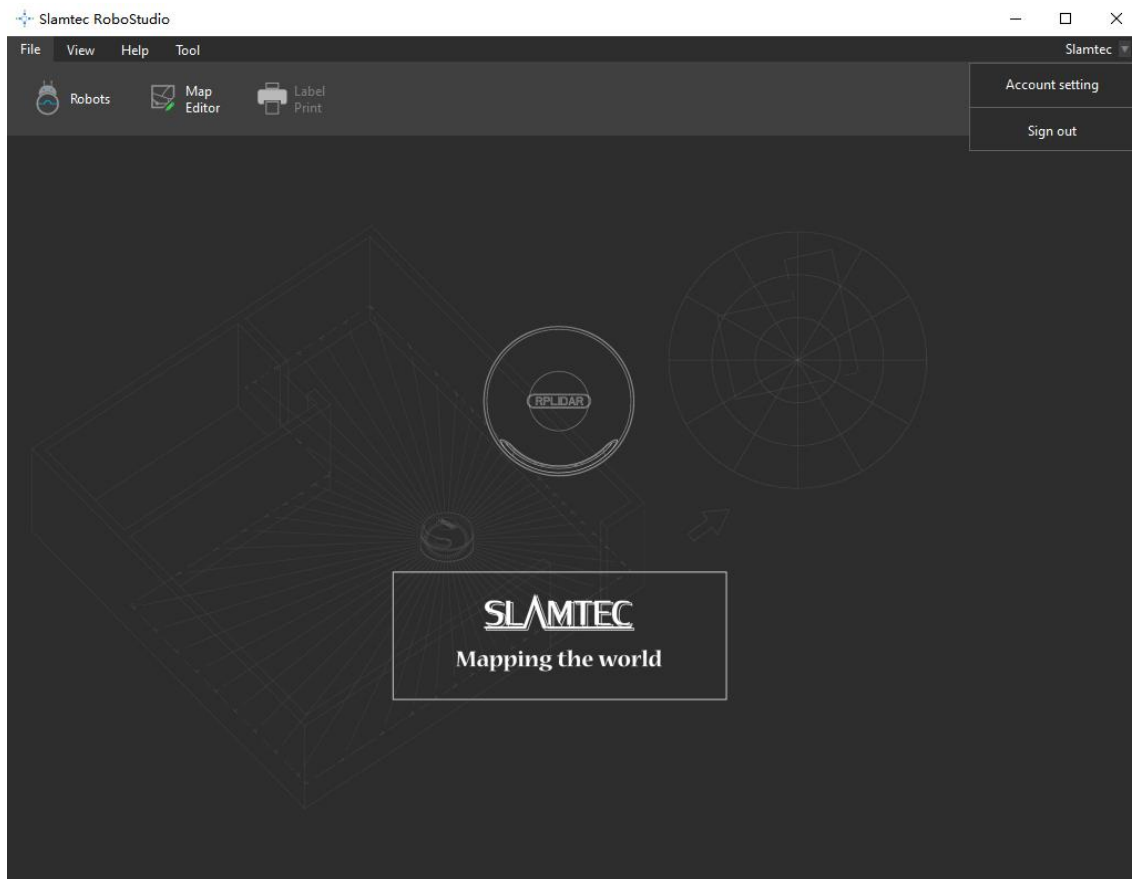


Figure 2.1.5 Major pane

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.

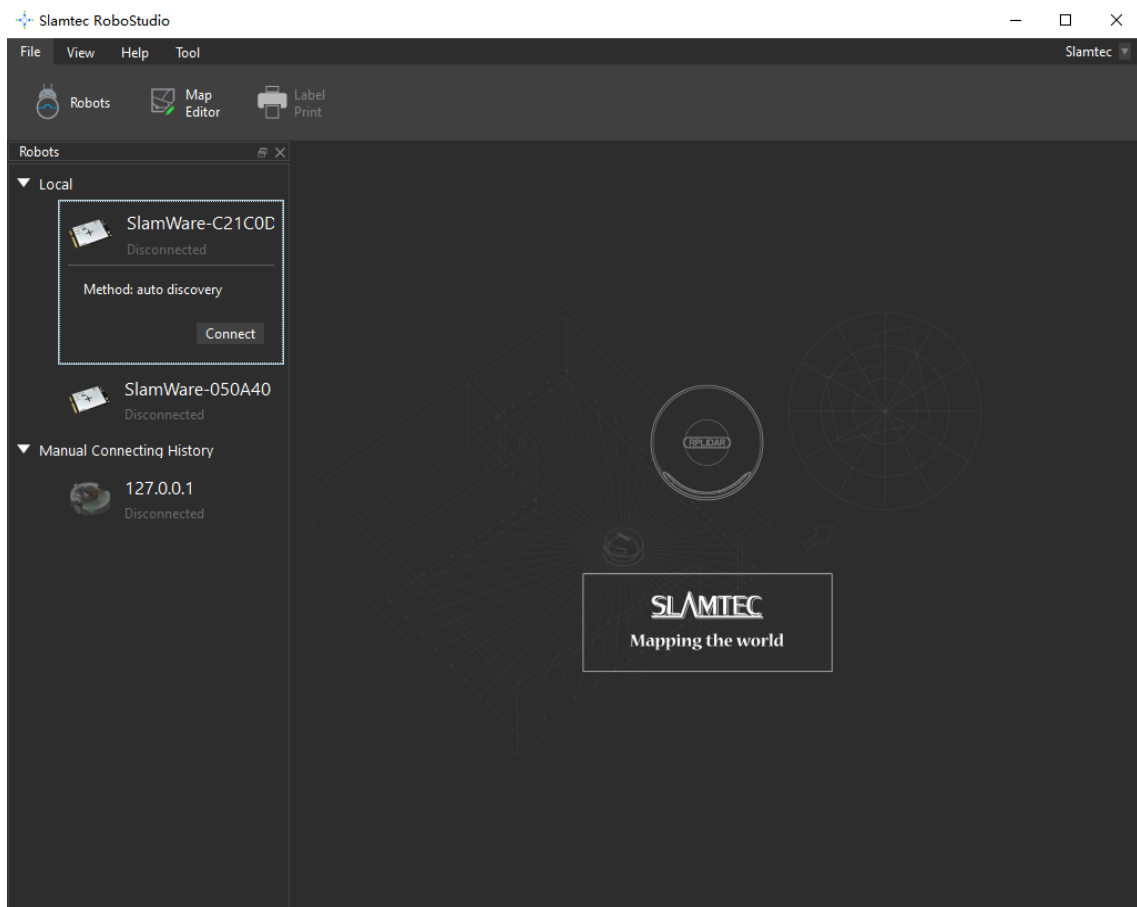


Figure 2.2.1 Docked window

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).

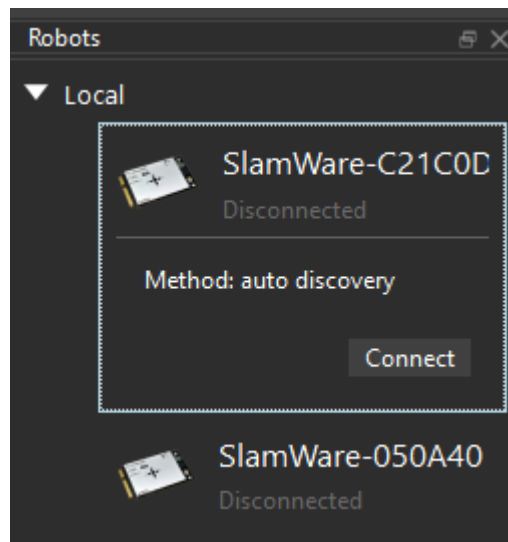


Figure 2.2.2 Connection by Connect button

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).

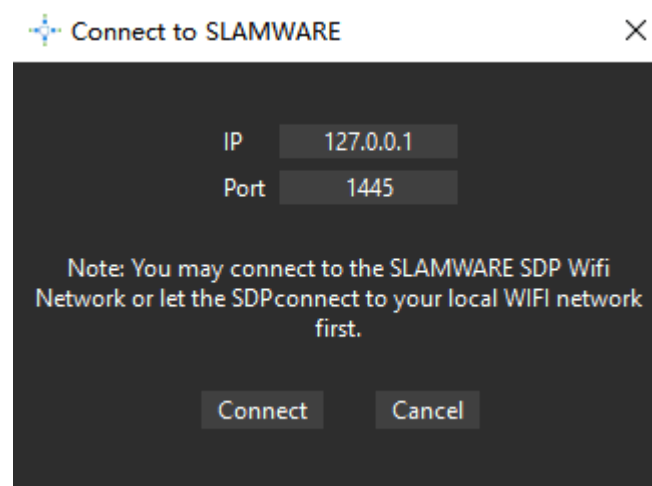


Figure 2.2.3 Manual connection

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)

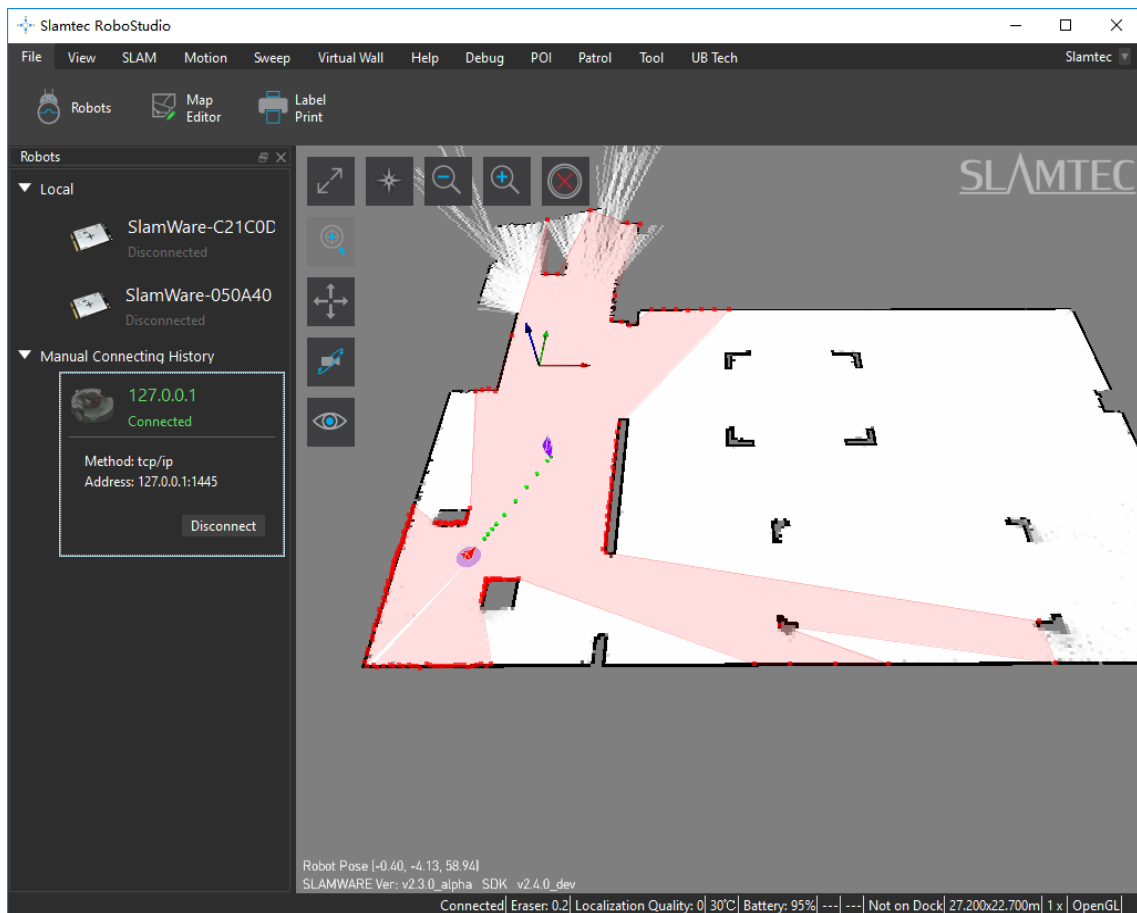


Figure 2.2.4 Successful connection

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 popup dialog, user can edit the robot name and its thumbnail (as in Figure 2.2.5).

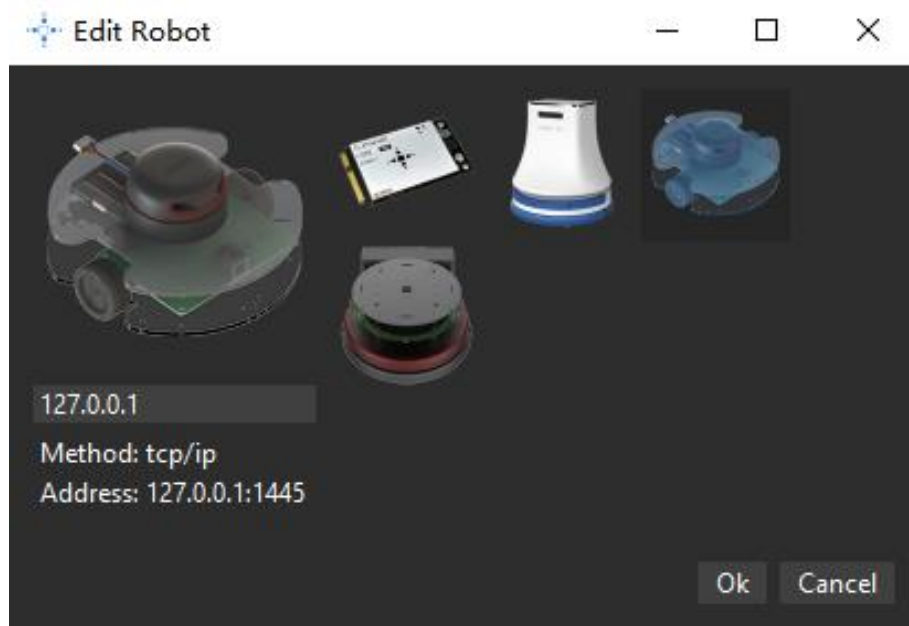


Figure 2.2.5 Edit Robot

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.

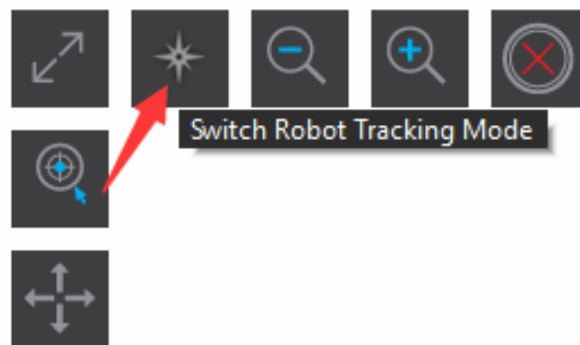


Figure 2.3.1 View Mode Switch

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.

Ctrl + Left Mouse Button:

In the navigation mode, hold **Ctrl** key down and left click any place on the map, which is similar to left click, and the robot will move to the new target more precisely(The robot center is more close to the target point).

Shift + Ctrl + Left Mouse Button:

The combination of **Shift + Left Mouse Button** and **Ctrl + Left Mouse Button**.

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**, the robot will turn left, turn right, move forward or move backward.

Stop:

Right click any place in the map twice, and 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.

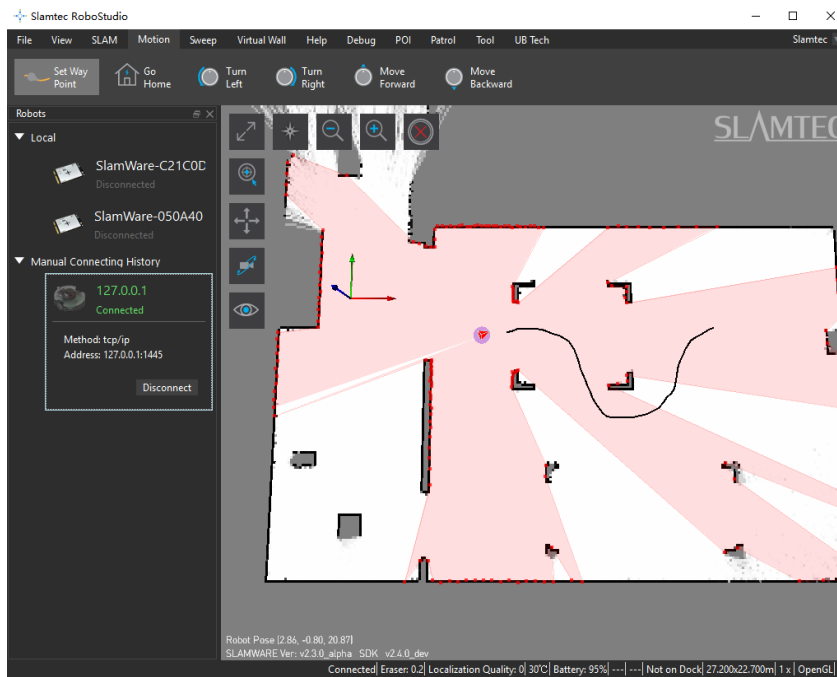


Figure 2.4.1 View Mode Switch

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).

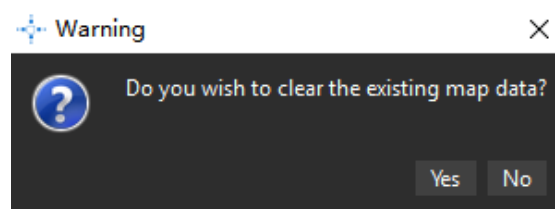


Figure 2.5.1 Clear Map Data

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.

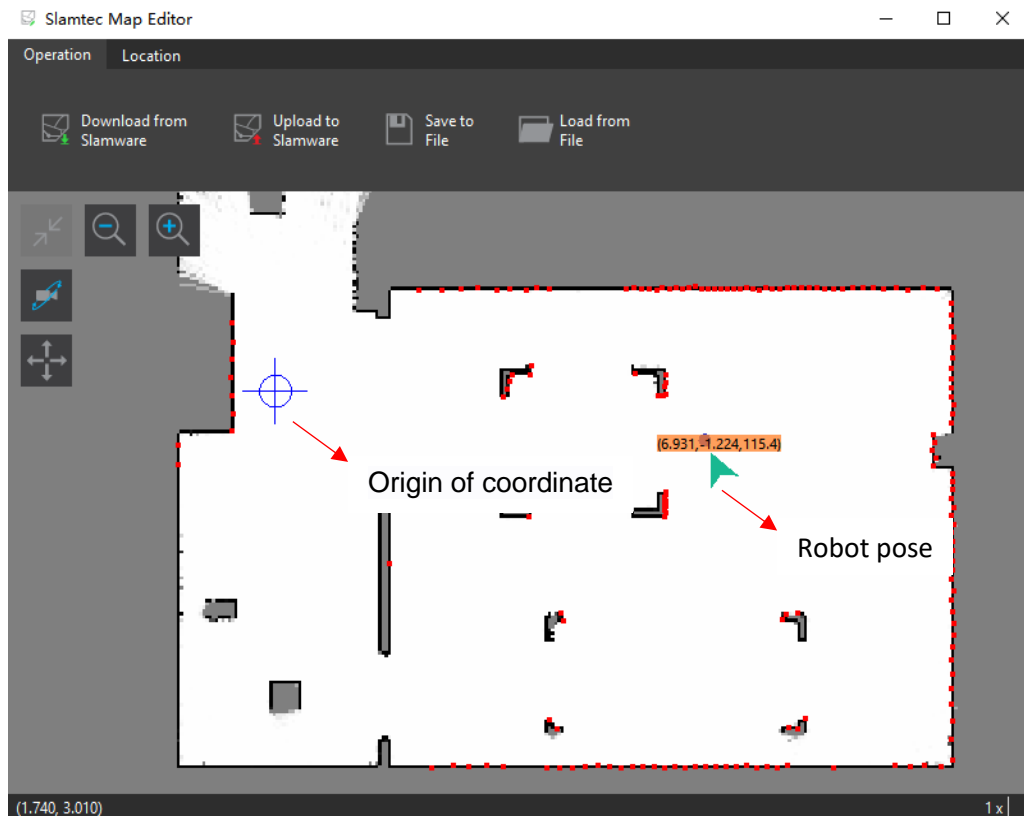


Figure 2.5.2 Map Editor

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.

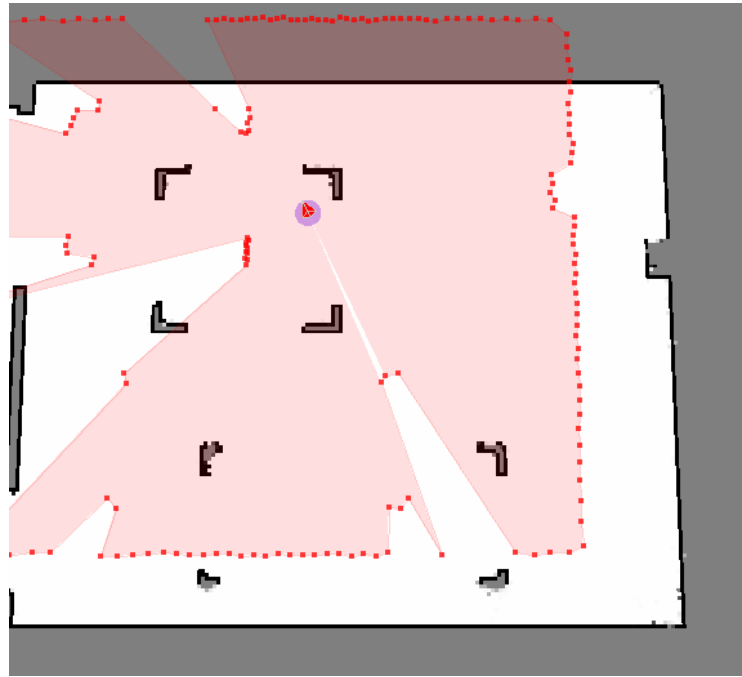


Figure 2.5.3 Localization Deviation

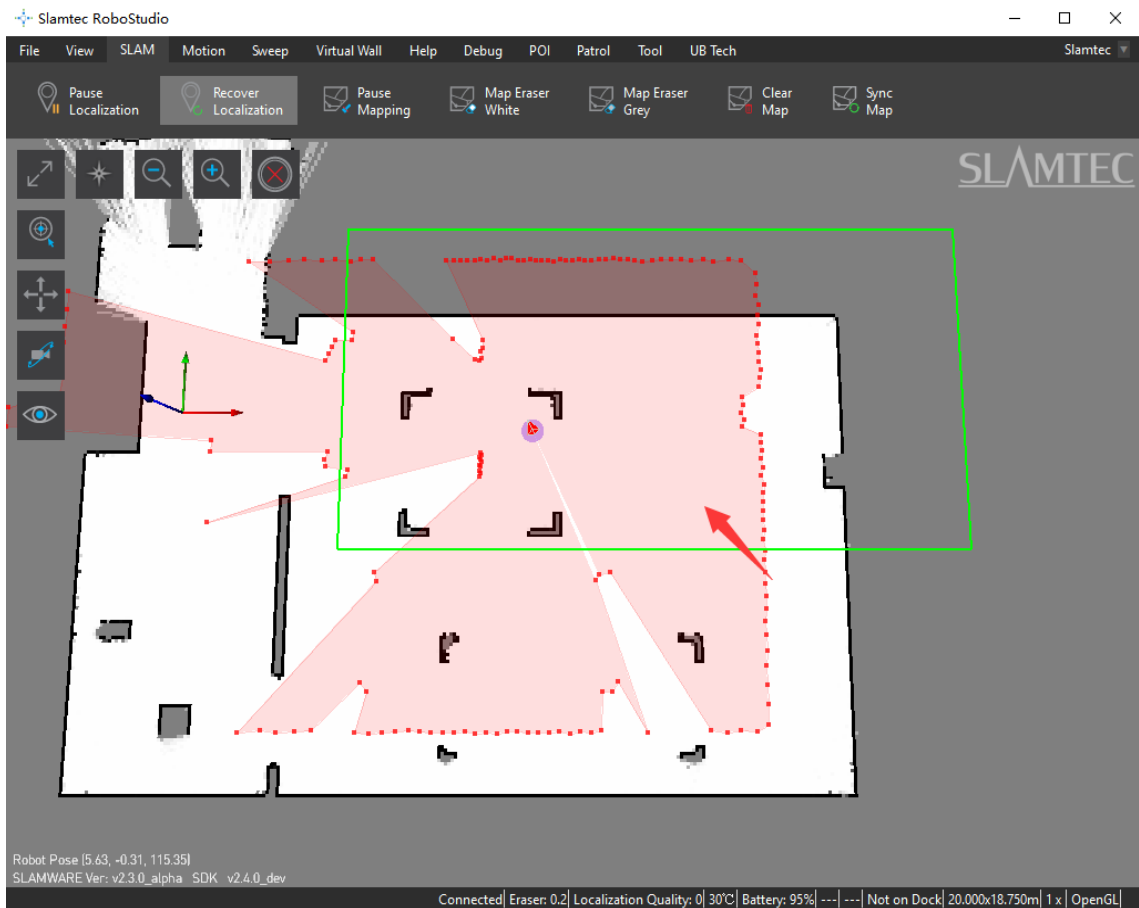


Figure 2.5.4 Select efficient area

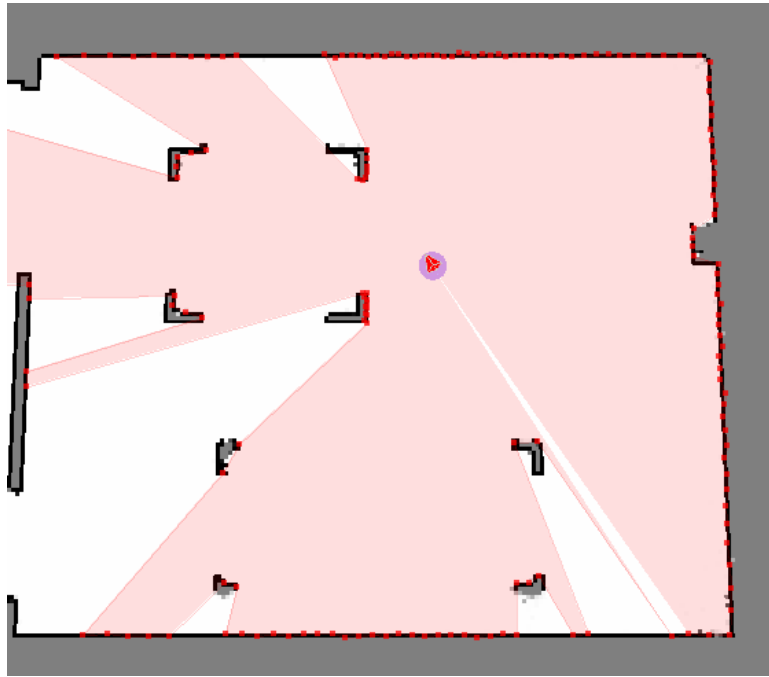


Figure 2.5.5 Localization recovered

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.

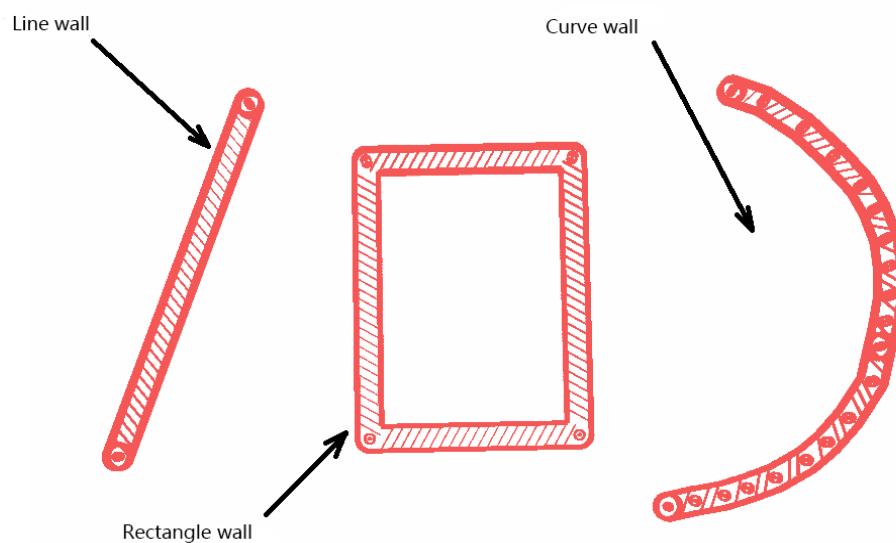


Figure 2.6.1 Different Virtual Walls

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.

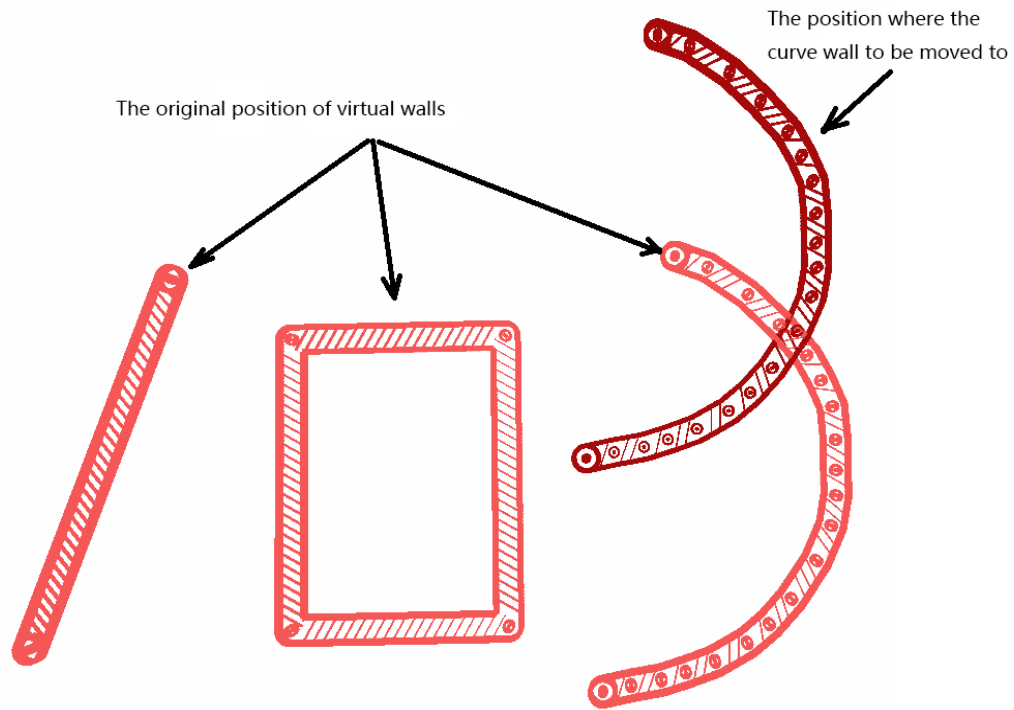


Figure 2.6.2 Drag the virtual wall to a new place

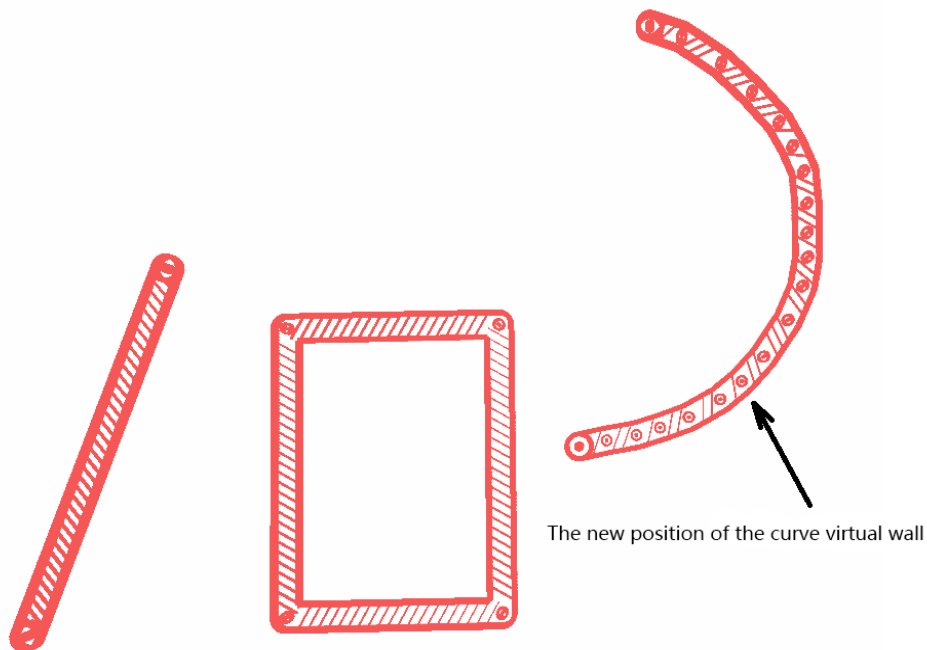


Figure 2.6.3 The virtual wall has moved to a new place

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.

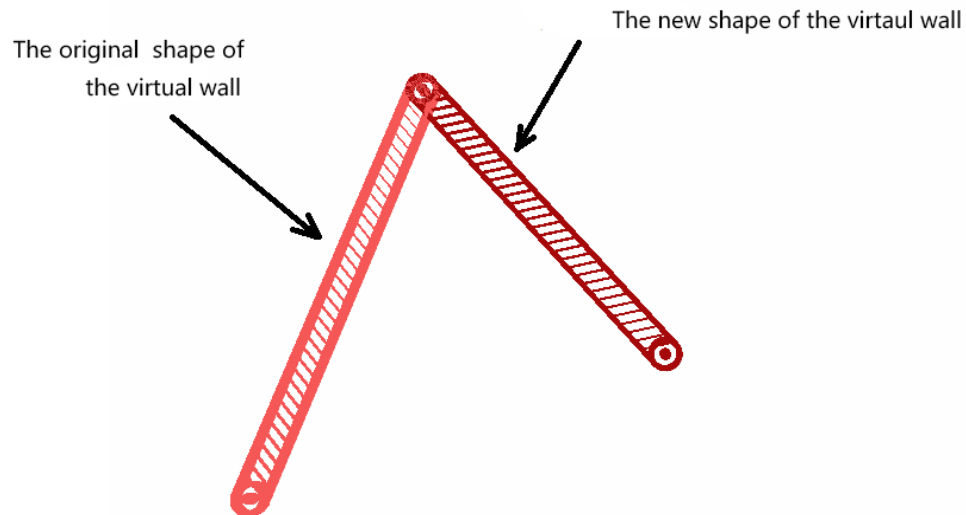


Figure 2.6.4 Choose the virtual wall and drag its endpoint

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.

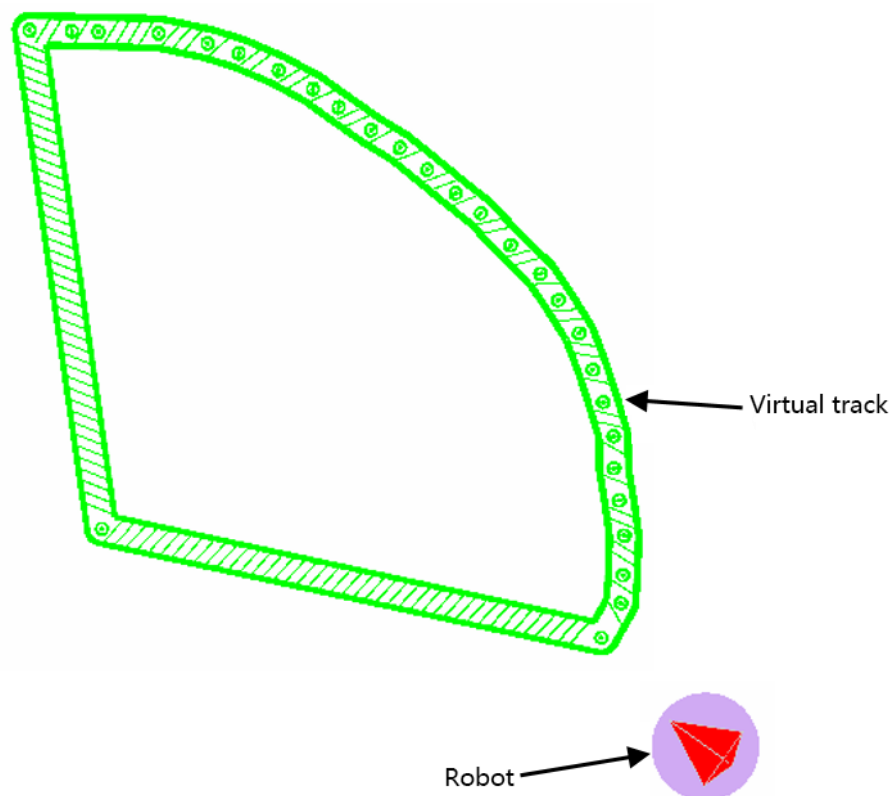


Figure 2.7.1 Virtual Track

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.

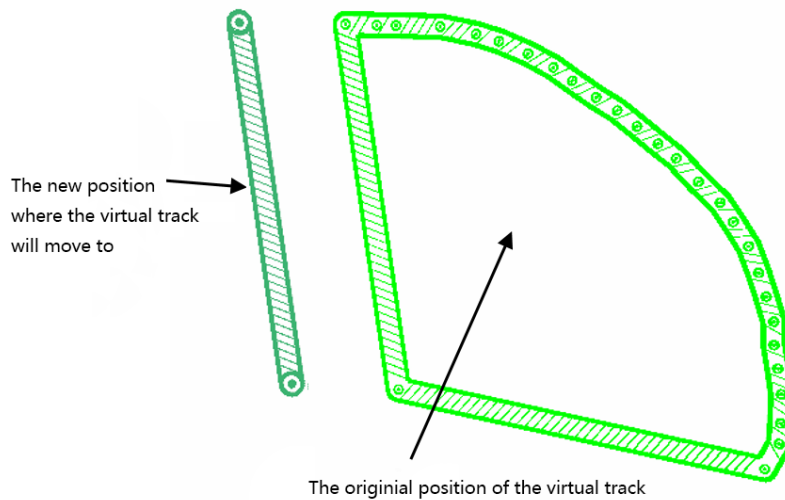


Figure 2.7.2 Choose and drag a virtual track

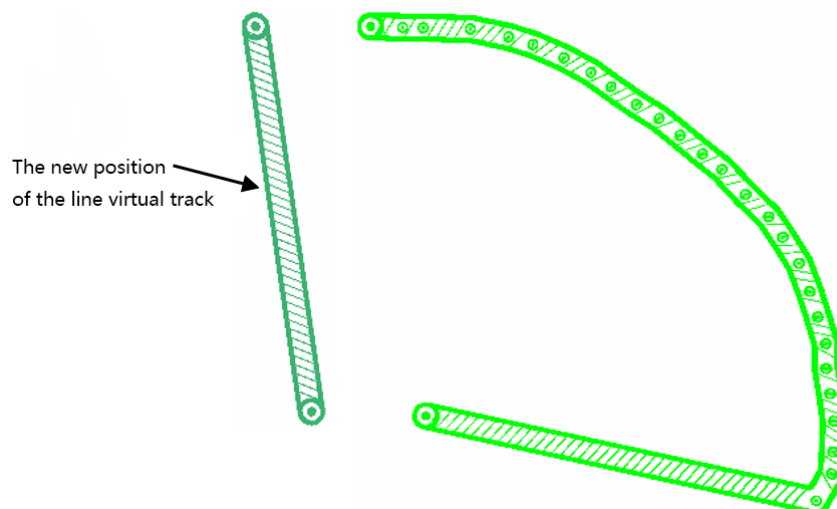


Figure 2.7.3 The virtual track has moved to a new place

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.

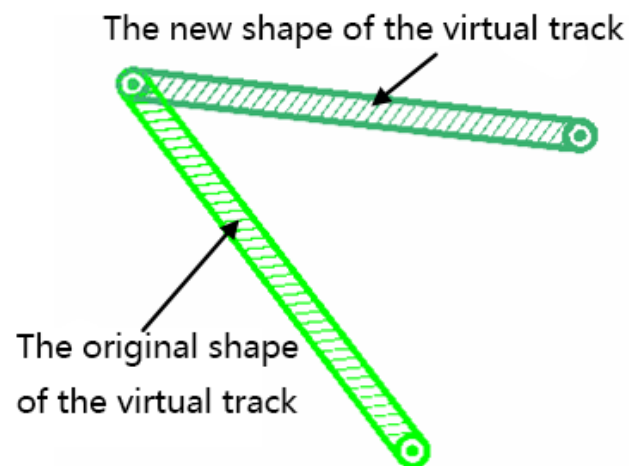


Figure 2.7.4 Localization recovered

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 **Virtual Track Navigation** 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 **Ctrl** key and **Shift** key is still valid.

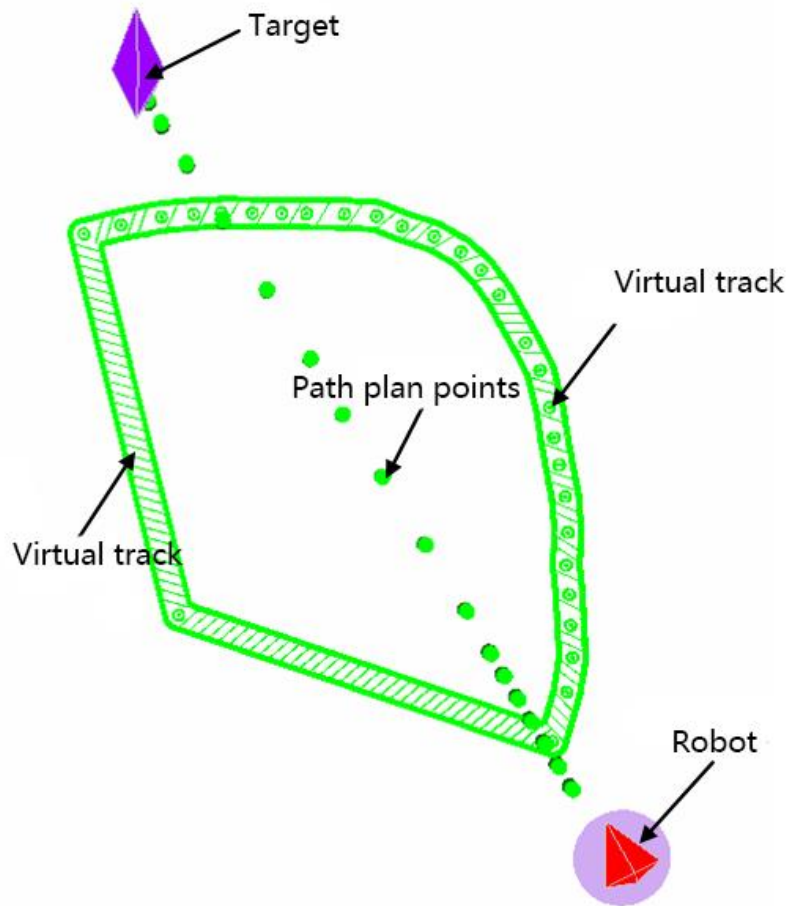


Figure 2.7.5 Path finding in normal navigation mode

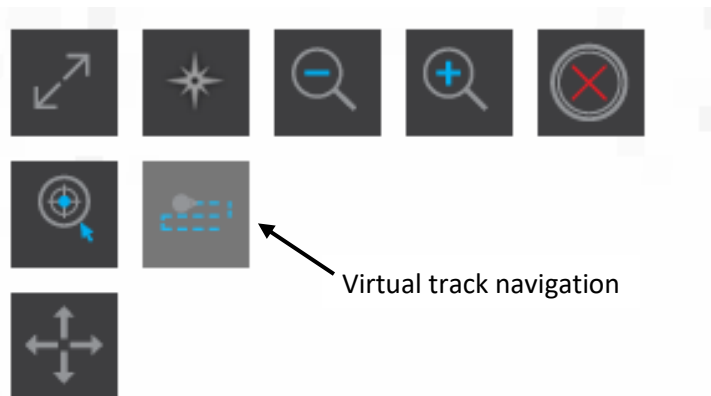


Figure 2.7.6 Virtual track navigation button

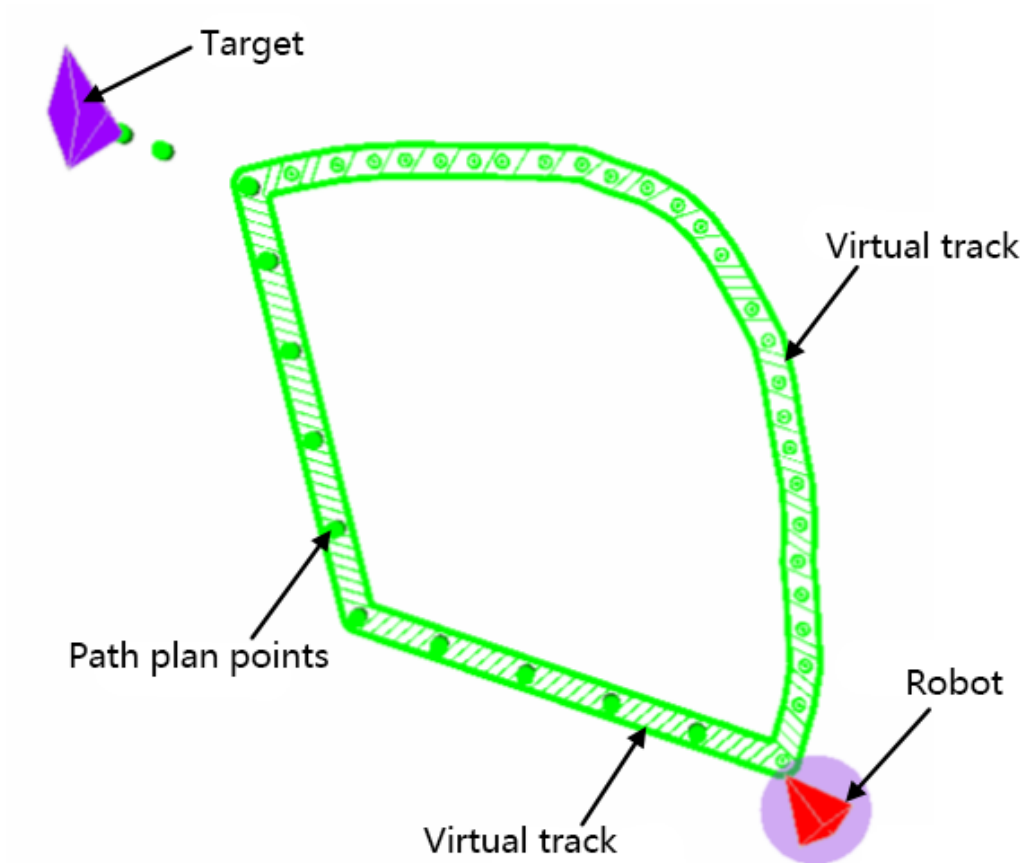


Figure 2.7.7 Path finding in virtual track navigation mode

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.

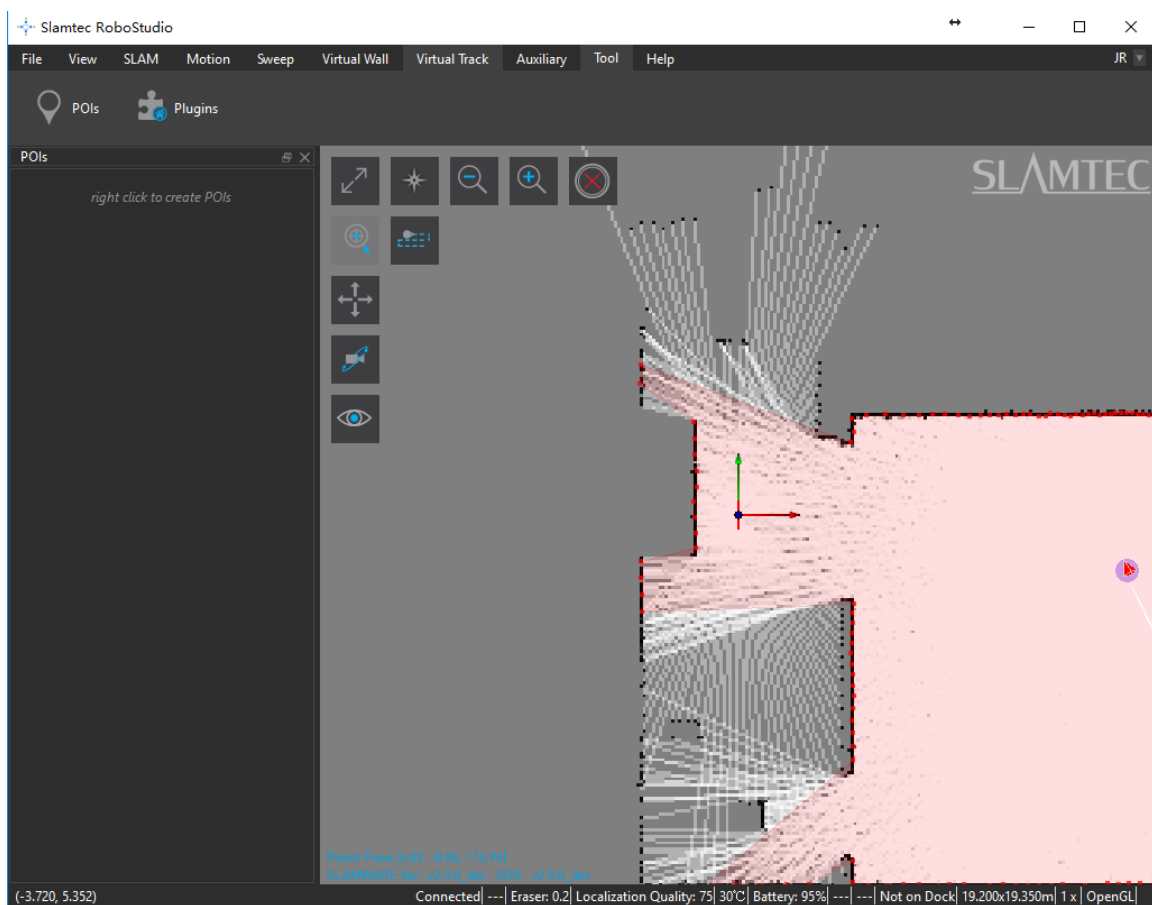


Figure 2.8.1 POI Management List

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.

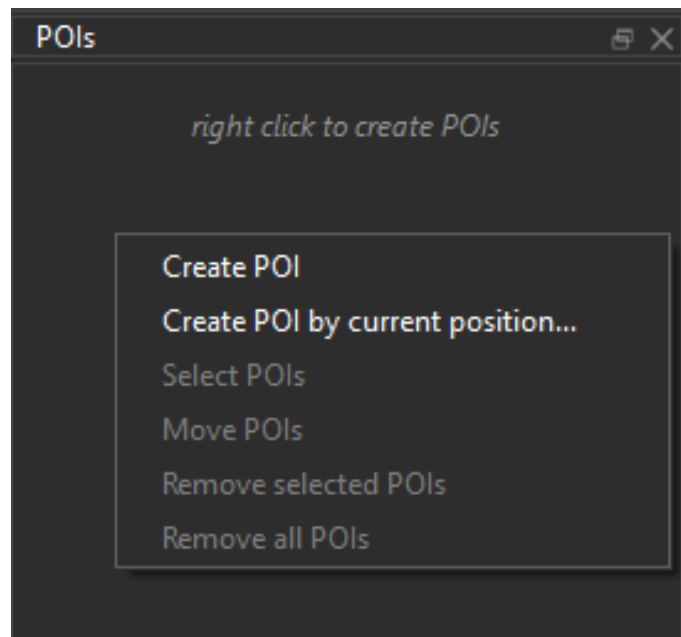


Figure 2.8.2 Right-click Menu In The White Space Of POIs list

In the following **POI Info** dialog box, users can edit the POI name, modify the value on X and Y axes 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.

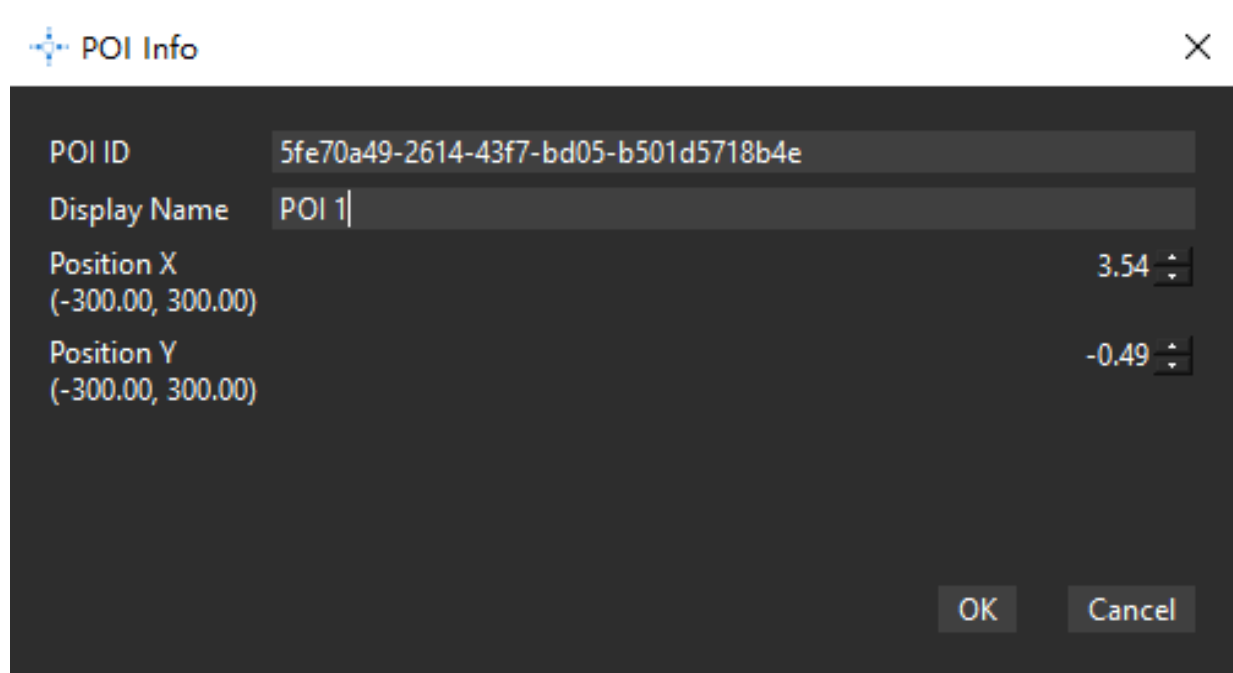


Figure 2.8.3 POI Info Dialog Box

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 in the box.

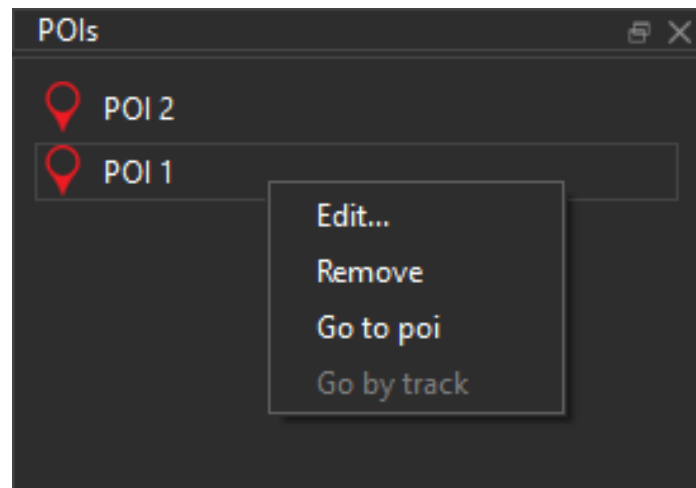


Figure 2.8.4 Right-click Menu In POIs

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.

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.

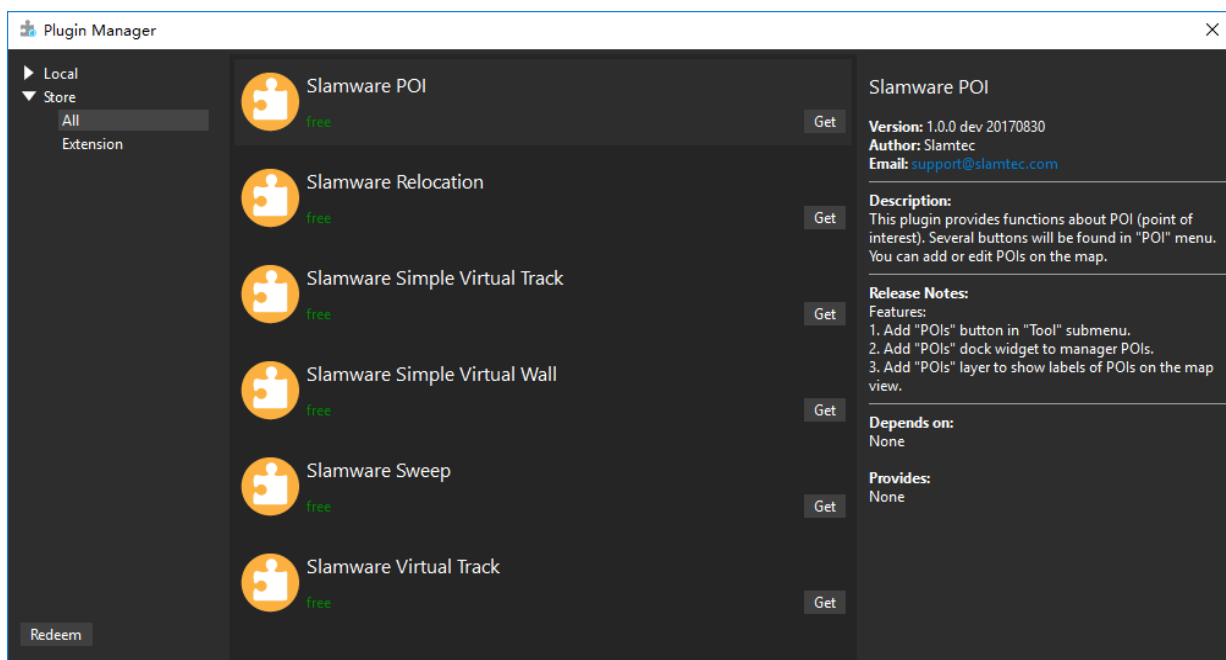


Figure 2.9.1 Plugin Manager Dialog Box

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.

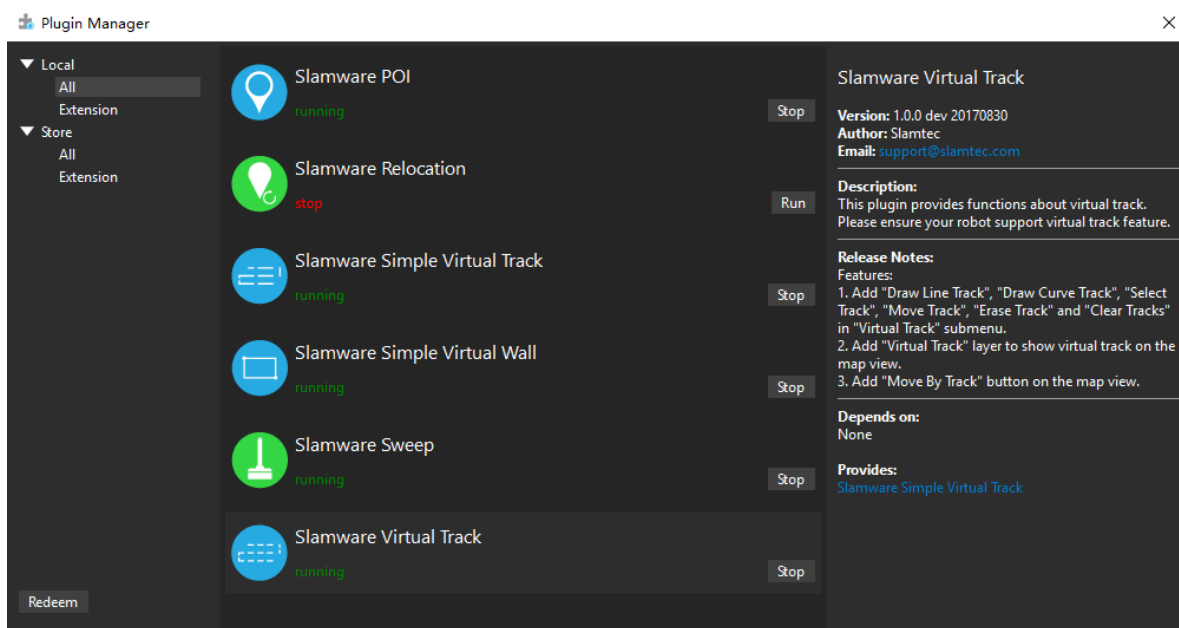


Figure 2.9.2 Local Plugin Management

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.

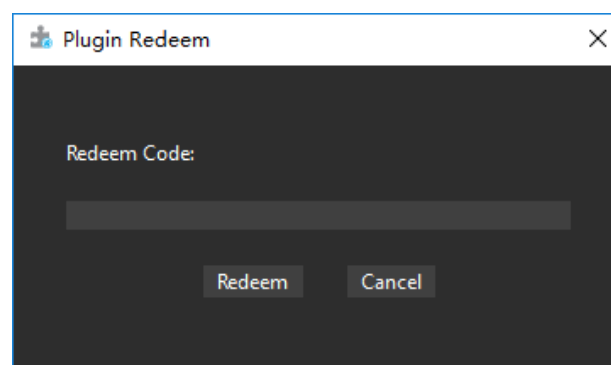


























Figure 2.9.3 Plugin Redeem Dialog

Menu bar

Menu	Button	Icon	Description
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.
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.
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

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