

ATHENA

General Purpose Robot Platform Professional Version

User manual

Model: N4M11



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Introduction

Athena is a low cost small-sized general purpose robot development platform developed by SLAMTEC to meet the requirement of small-size robot application like patrol robot, delivery robot and etc.

Its build-in SLAMWARE Cube autonomous localization and navigation module is designed to realize path finding and navigation. And different applications can be integrated with Athena to make it work in varies business places.

Athena is equipped with RPLidar, ultrasonic sensors, cliff sensors, bumpers, magnetic sensors, depth cameras and etc., which helps Athena walk freely and respond well in complicated business environments.

Basic Function

Autonomous Mapping for Localization and Navigation

The function of Athena platform is to realize autonomous map building, localization and navigation. There is no need for human assistance during its working process. It can find the proper path to a specified place by itself and move there freely. And it also supports multi-line patrol mode like a security guard.

Autonomous Recharging

We provide open source interface for users and developers to use it for their own upper application on Athena, which can realize the recharging feature of Athena, namely, the ability to go back to the charge station to charge itself when it has a very low battery.

Third Party Application Development

The Athena has a totally free platform both in software and hardware and we offer technical support for external extended hardware. Our users can focus on the developing of business logic application via SLAMWARE SDK.

Interior Module Block Diagram

The following figure describes the communication between Athena and external system, the connection of power supply and emergency stop.

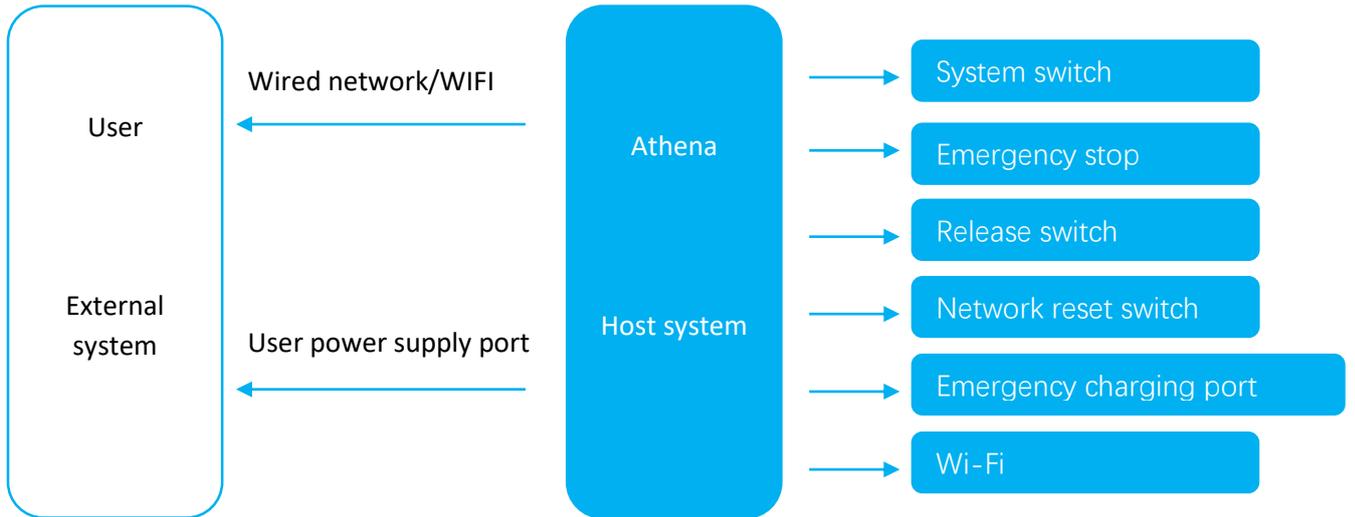


Figure 1-1 Connection between Athena and External System

Sensors

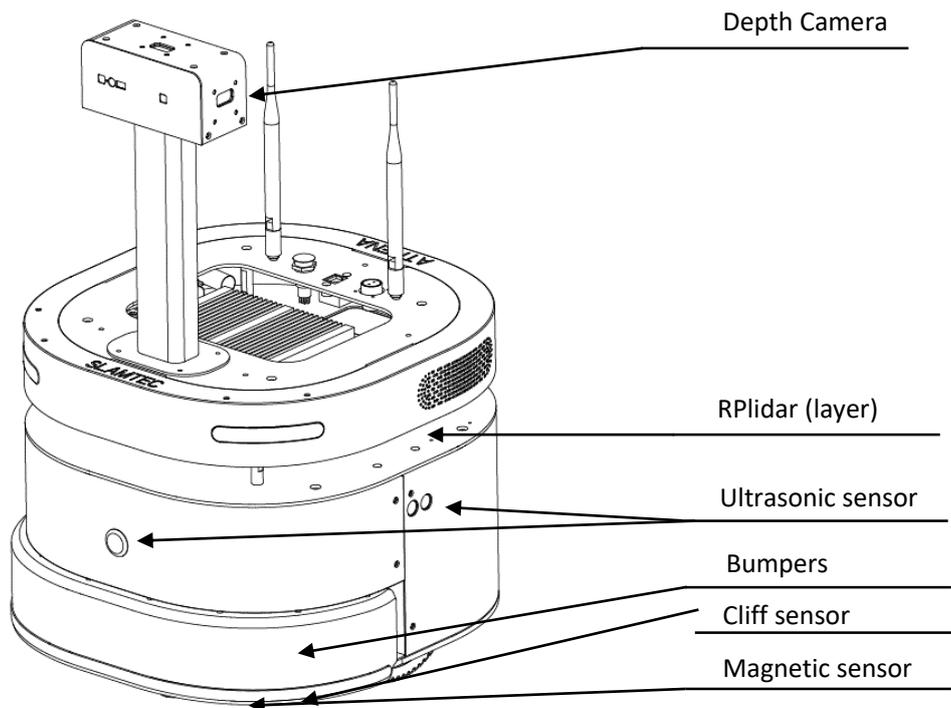


Figure 2-1 Athena Sensor Configuration

Interfaces

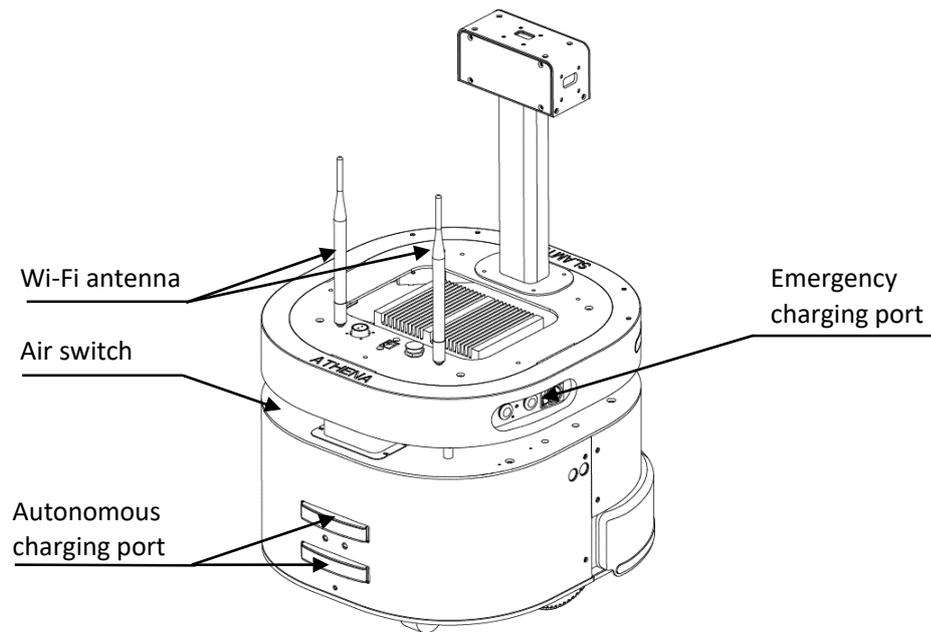


Figure 2-2 Athena Interfaces Configuration

Indicator Status

Indicator status				
No	Status	Left	Right	Status Description
1	None	Off	Off	Power off
2		Blink	Blink	Low battery(lower than 15%)
3	Red	On	On	There is health information (Emergency stop or sensor errors).
4	Green	Blink	Blink	Emergency charging or autonomous recharging
5		On	On	Fully charged

6		Blink	Off	Turn left
7	Blue	Off	Blink	Turn right
8		Blink	Blink	Walk straight
9		On	On	Stop(After turn on the robot)

Figure 2-3 Athena Indicator Status

Under low battery, Athena also has status like health information,turnning left, turnning right and etc.. Therefore, we redefine the status under low battery as below to avoid confusing those status.

Indicator status under low battery

No	Status	Left	Right	Status Description
1		On	On	There is health information.
2		Blink	Blink	There is no other health information except for low battery.
3	Red	Blink	Blink	Emergency charging or autonomous recharging
4		Blink	Blink	Turn left
5		Blink	Blink	Turn right
6		Blink	Blink	Walk straight

Figure 2-4 Athena Indicator Status Under Low Battery

Charging Station

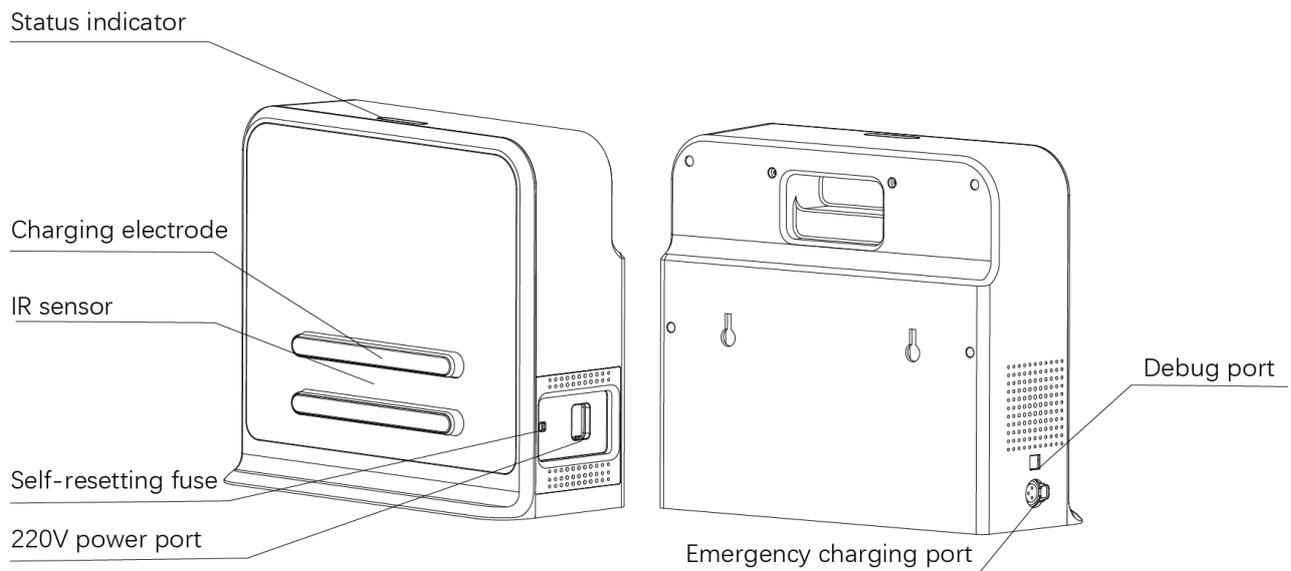


Figure 2-5 Athena Charger

Product Packing List

Item Name	Quantity	Remark
Athena	1	Athena platform
Wi-Fi antenna	2	Come with Athena as accessories and need to be installed on Athena.
Depth camera and its mounting structure	1	Come with Athena as accessories and need to be installed on Athena.
Screws	1	Screws for mounting depth camera
Charging station	1	Come with Athena and need to choose a proper place before using it.
Power cable of charging station	1	Come with charging station as accessories. Please connect the charging station and 220V power with the power cable.
Emergencing charging cable of charging station	1	Come with charging station as accessories. Please connect the charging station and Athena with the charging cable.

Introduction

As shown in the following figure, the extended platform of Athena is a square table(404mm*390mm in dimension). The whole top surface is all-steel. There are five M5 threaded holes regularly distributed on the table, which can meet various requirements of fixing the upper module on the Athena. Please refer to the following figure for the specific position of threaded holes and the port dimensions.

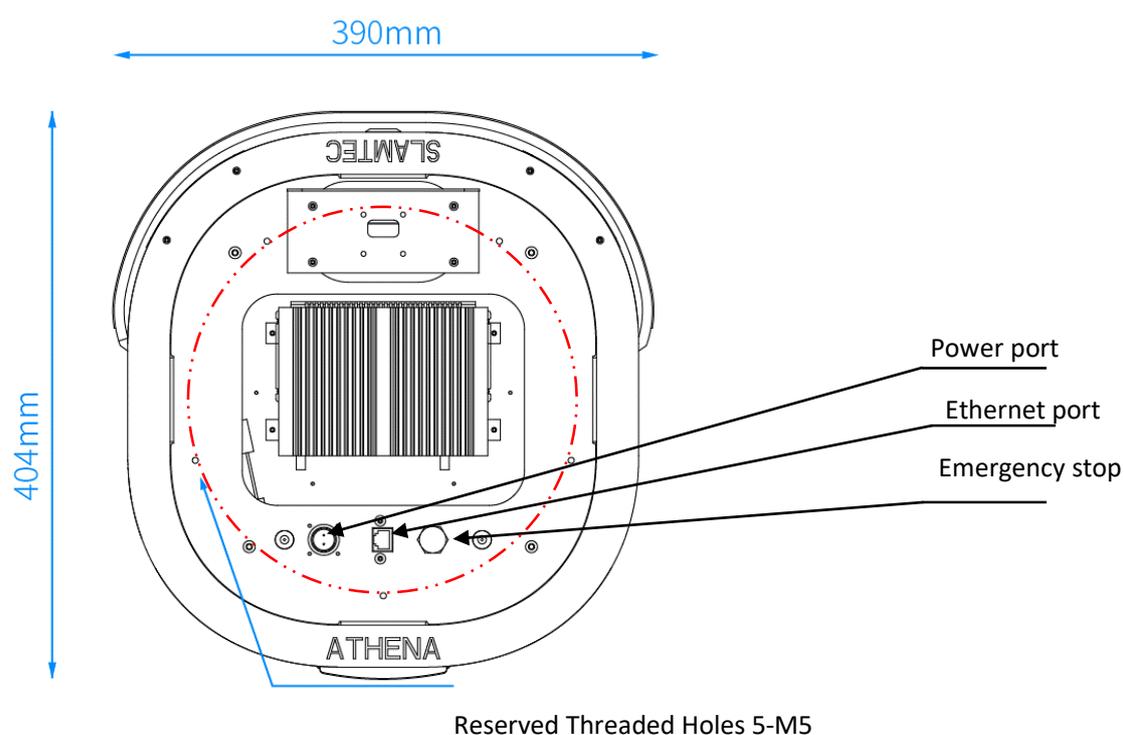
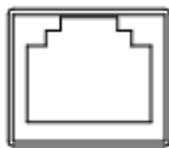
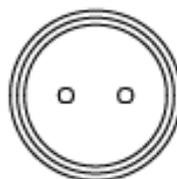


Figure 3-1 Athena Extended Platform

Port Definition



Ethernet port model:
Standard RJ45



Power port model:
WS16K2Z WEIPU 2Pin Aerial Socket

Figure 3-2 Interface Definition of Athena Extended Platform

Name	Parameter	Description	Note
Ethernet port	1000/100/10Mbps	Used for communication between users and Athena.	IP Address 192.168.11.1 ~ 192.168.11.100 are reserved for the bases of Athena. Therefore, when using this Ethernet port, please ensure that the IP address of the device connected to Athena not uses the above IP address. Or IP conflict may occur. Please refer to the SLAMWARE SDK for detailed communication protocols.
Power port	DC 18-25.2V 5A Max	Used for providing power supply for the device of users.	The end marked as 1 is positive while 2 is negative.
Emergency charging port	25.2V 6A	Used for charging Athena under unexpected situations such as the charger electrode not working.	Standard charging: 6A Quick charging supported:10A

Supported Switch Type and Description of Control Port

Switch Name	Description	Note
Emergency stop switch	Used for controlling Athena in emergencies. Athena will stop moving immediately after pressing this switch.	This switch is a must to design, or Athena will refuse to work.
Release switch	Corresponded with the emergency stop switch, after pressing down the emergency stop switch, user needs to press the release switch to recover Athena to normal status and continue other operations	
System switch	This switch is the power switch for the whole system. Short press for power-on and long press for power-off.	<p>Checking method Internal pull-up to check the time width of the low level.</p> <p>Open time: 50ms~3000ms(Typical value is 300ms, and it is invalid to repeat this operation if it has already been in open status.)</p> <p>Close time: 3000ms~15000ms(Typical value is 4000ms, and it is invalid to repeat this operation if it has already been in open status.)</p>
Network resetting switch	This switch is used to reset the wireless network.	When the network is abnormal, please long press the network resetting button for 3 seconds to reset Wi-Fi.

Figure 3-3 Supported Switch Type of Athena Extended Platform Control Port

Athena Reference Design

1. Depth Camera Reference Design

ATHENA

Custom Design Reference

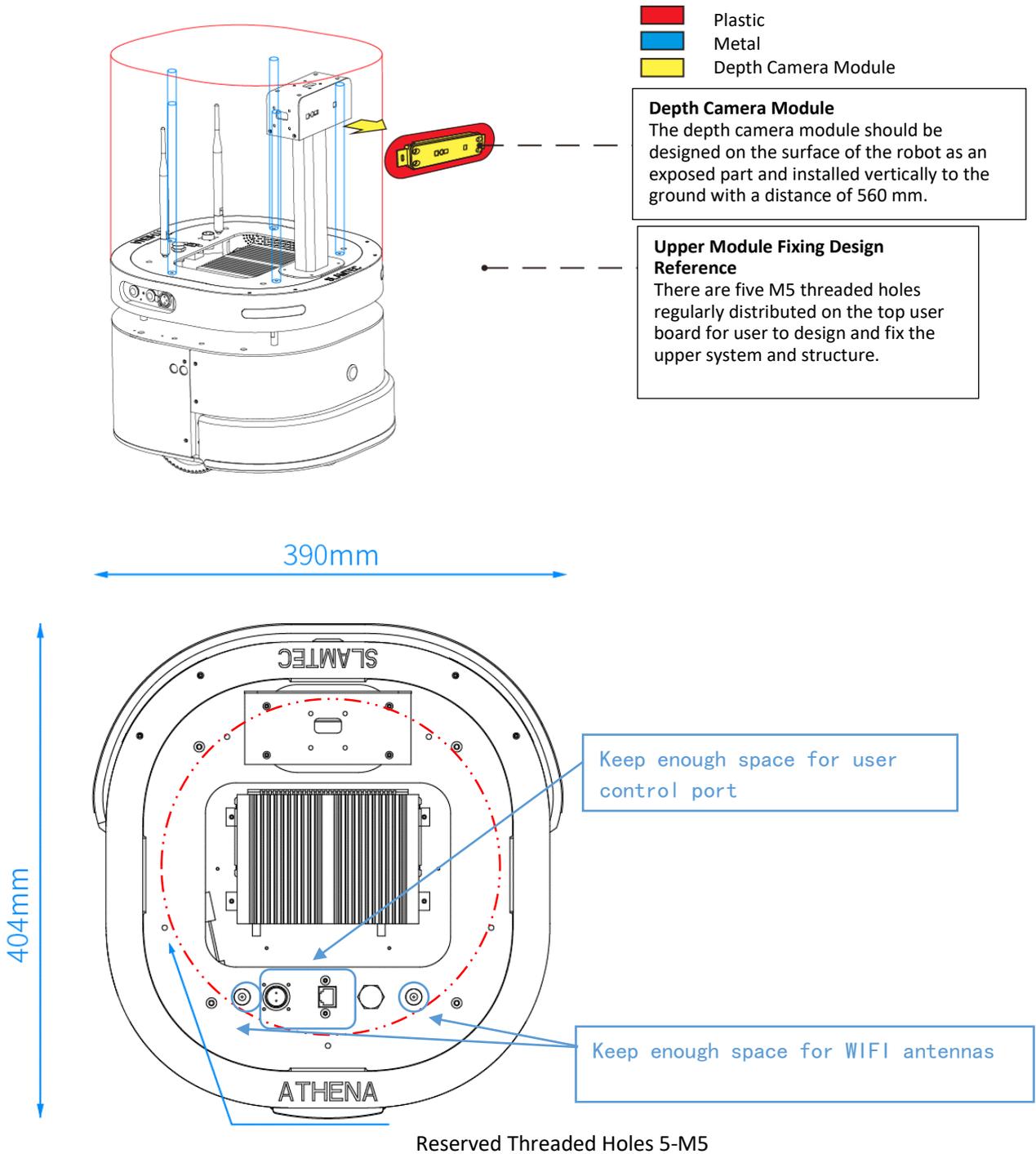


Figure 3-4 Athena Reference Design

2. Upper Module Reference Design

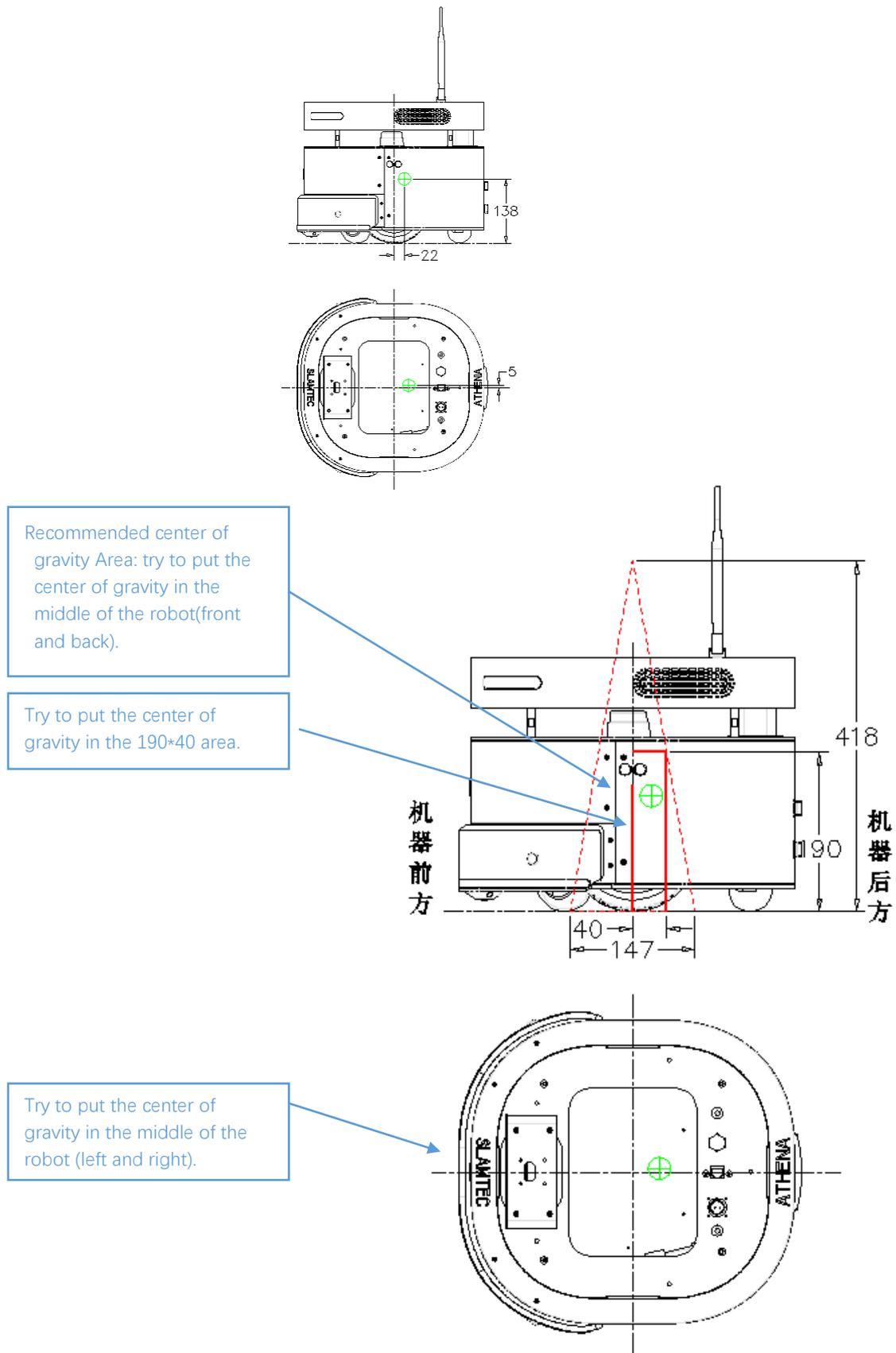


Figure 3-5 Athena Reference Design for Center of Gravity

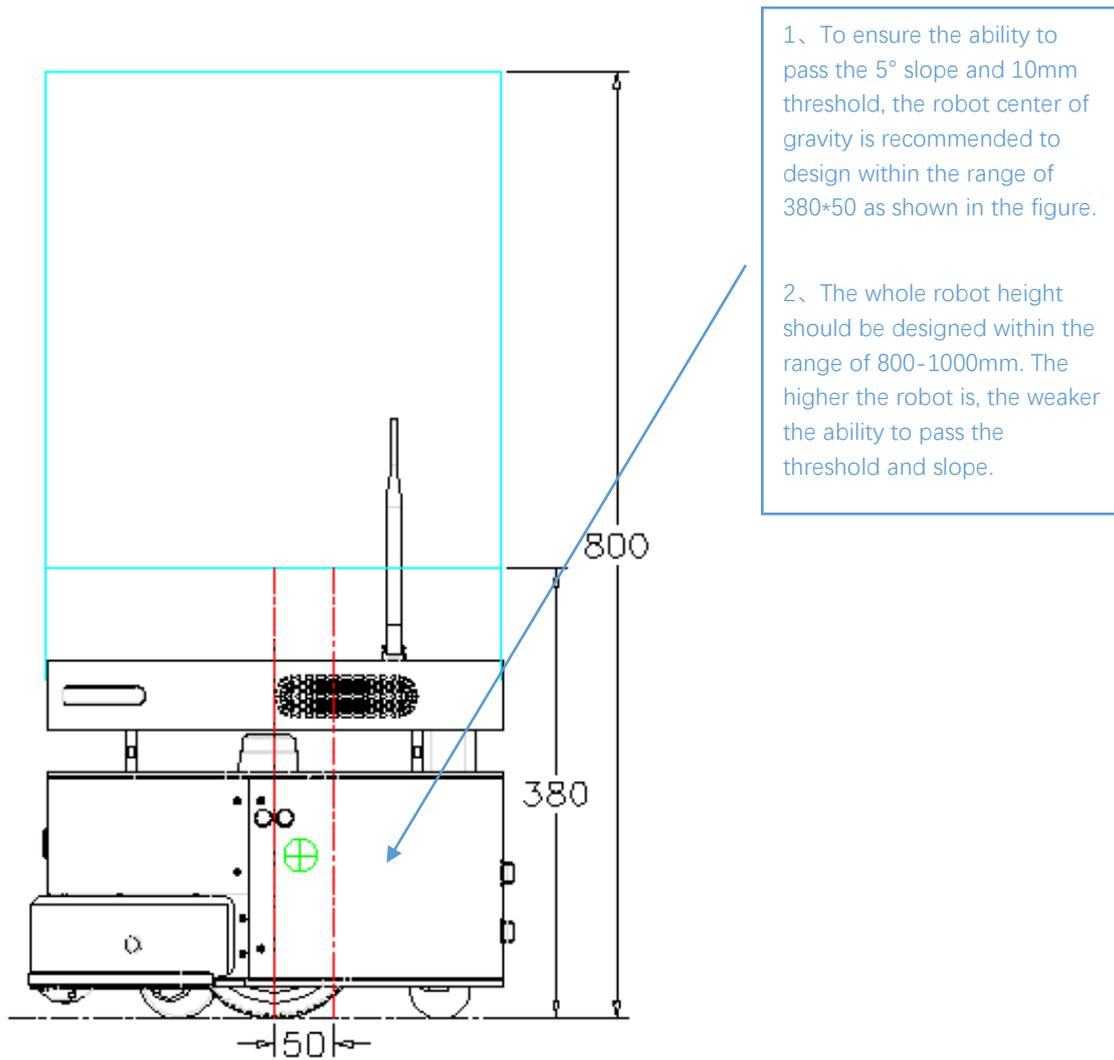


Figure 3-6 Athena Reference Design for Center of Gravity

Athena Deployment

1. Place Charger

With the charger, Athena can recharge itself automatically. Therefore, the charger requires to be put properly to ensure its performance. When Athena goes back to the charger, it will have a driving force, so it's better to put the charger back against a wall. And the wall should meet the following requirements.

- a. The charger should fit the wall closely and there is no obstacles between them. The wall with skirting line is not recommended.
- b. The wall should not be made of transparent material like mirror or glass.
- c. The wall should be at least three times the width of the charger.
- d. The wall should be a straight wall instead of a curved one.

The charger requires a 220V power supply and its external power supply wire is 1.5m in length. So it's better that there is a power port on the wall for the charger(the power board is not recommended since it may cause danger due to messy wires).

The ground in front of the charger should meet the following requirements:

- a. Open. There is no obstacles in front of the charger (with the charger as the center and within a radius of 2 meters from the center).
- b. Level. There is no slope on the ground.
- c. There is no soft carpet on the ground which leads Athena sinking into it more than 2cm.

Please always launch Athena from the charger to ensure that it can recharge itself properly.

Note: if the charger is moved to a different place when using Athena, user should reset the charger position accordingly when loading the map. Please refer to the detailed interfaces description in our SDK document.

2. Launch Athena

As shown in the following figure, find the air switch and turn it on, then press the system switch to start the system. Once succeeded, the system indicator turns on and the buzzer beeps several times. It takes one minute to start the system.

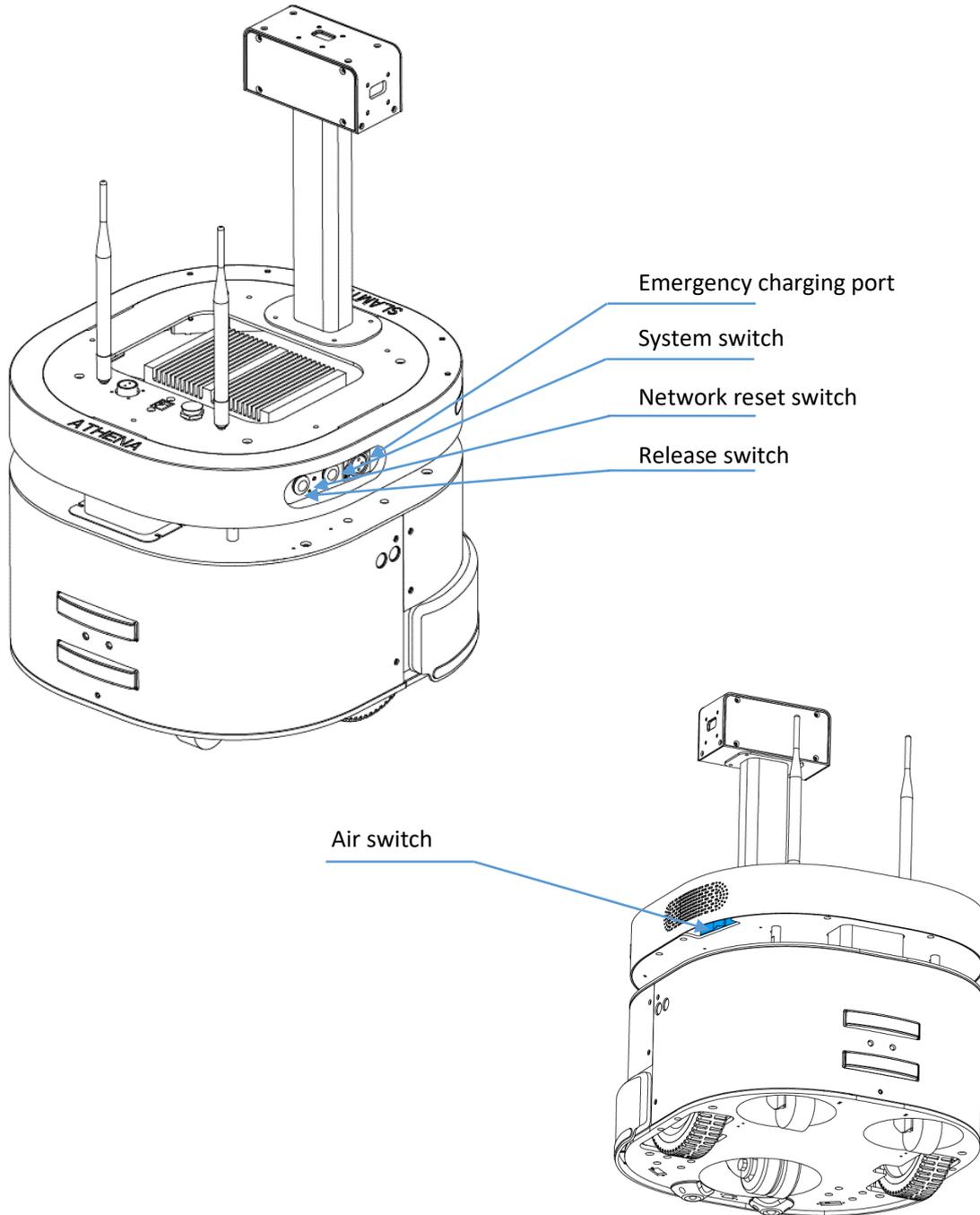


Figure 4-1 Athena Air Switch and System Switch

3. Build and Save Map

Download and install the robot graphical tool RoboStudio from our official website <http://www.slamtec.com/cn/RoboStudio>. Register and login to the tool. By clicking **File->Robots** in the menu, user can find a docked window opened in the left side of the pane as in Figure 4-2. In this window, user can connect to or disconnect from robots.

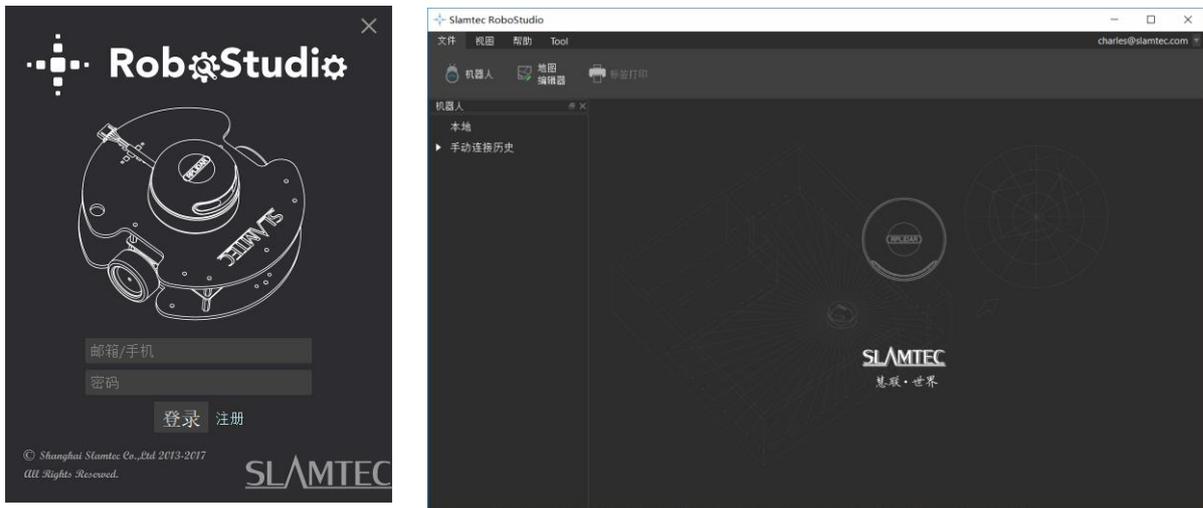


Figure 4-2 RoboStudio Robot Interface

Right click the whitespace of the robot list -> choose **manual connect robot** in the prompt dialog box, -> enter the IP address and port number in the new dialog box -> click **Connect** to connect to the robot as shown in the following screenshot. If you have already connected to the SSID obtained in step 3 via network adapter on computer, please enter the default IP address 192.168.11.1 in the above dialog box. (The IP address of your wireless adapter network should be DHCP mode)



Figure 4-3 RoboStudio Robot Connection Dialog Box

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 below.

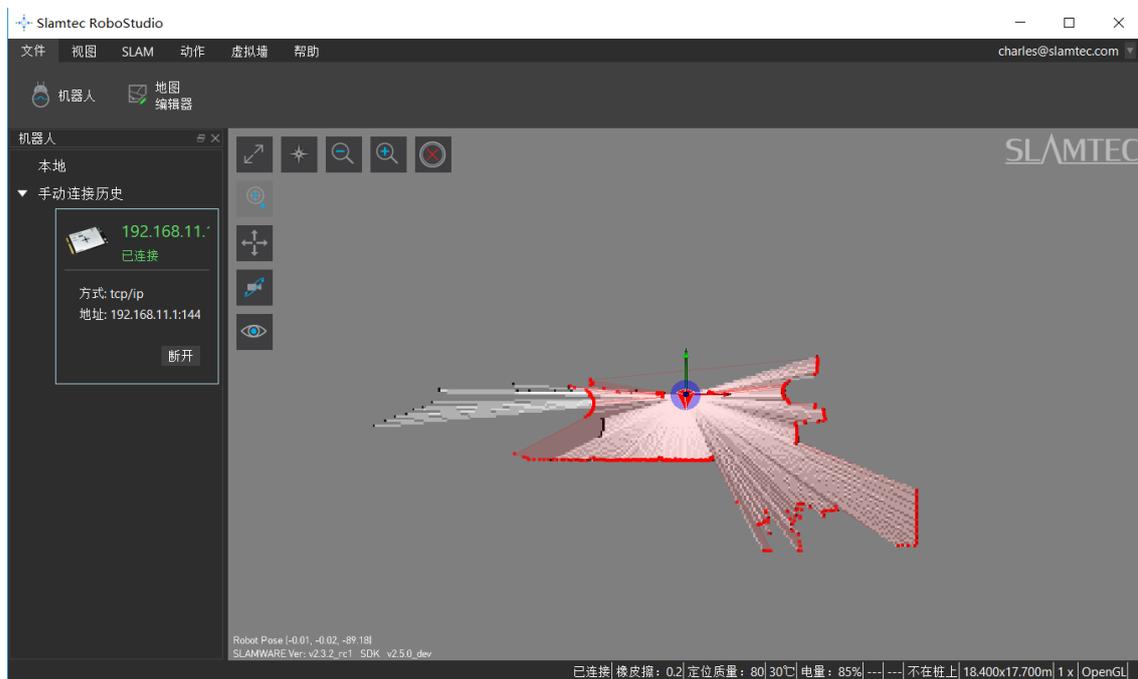


Figure 4-4 RoboStudio Robot Connection

Right click a point in the place where you want to build a map, and Athena will follow the point to build map. After mapping, add virtual walls to the places where you want to isolate them from robot. Click **File->MapEditor** and choose saving the map file to local or uploading it to the firmware.

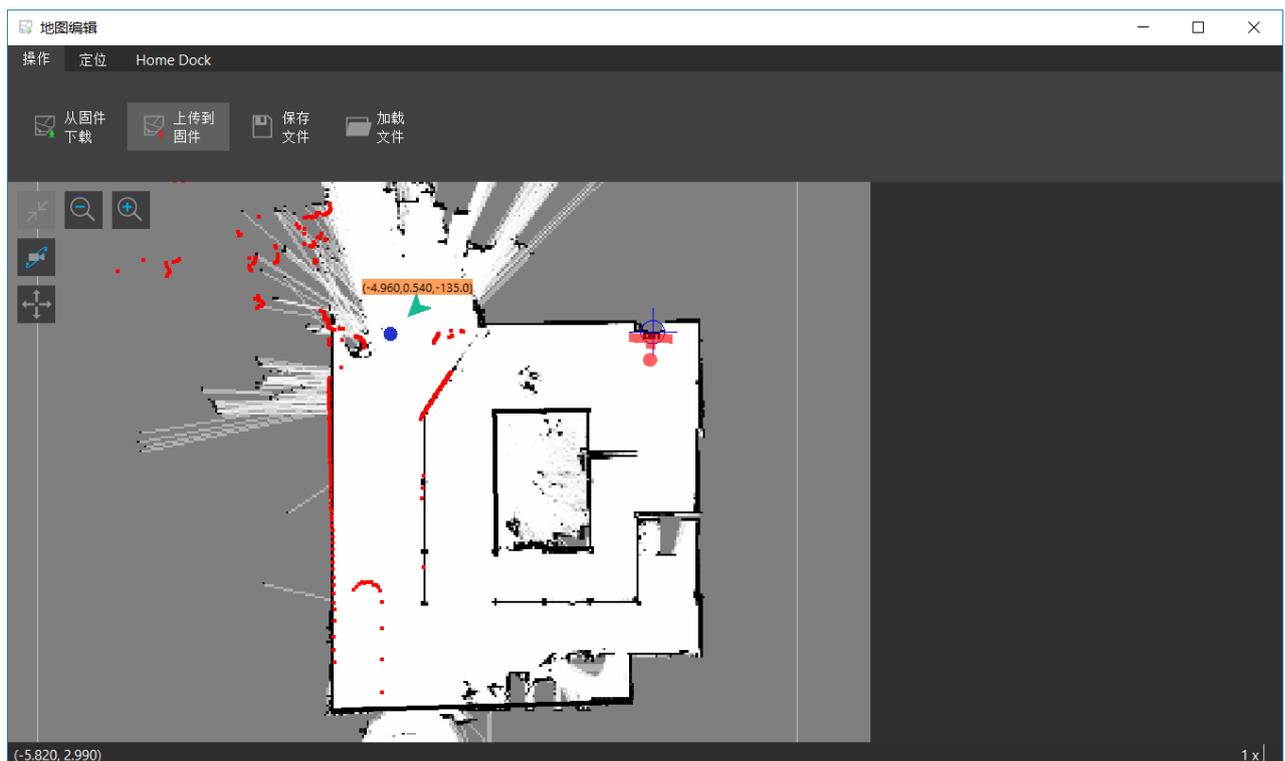


Figure 4-5 RoboStudio Robot Map Editing Window

4. Launch Host Computer and Load the Map

The following code shows how to finish loading specified map by using SDK on the upper computer.

```

1.  /*
2.  * upload map file to Athena
3.  */
4.  #include <iostream>
5.  #include <rpos\robot_platforms\slamware_core_platform.h>
6.  #include <rpos\robot_platforms\objects\composite_map_reader.h>
7.  #include <rpos\core\pose.h>
8.
9.  using namespace std;
10.
11. int main()
12. {
13.     try
14.     {
15.         string map_path = ".\\map.stcm"; //the path of map
16.         string Athena_ip = "192.168.11.1"; //the ip of Athena
17.         int Athena_port = 1445; //the port of Athena ,default is 1445
18.
19.         rpos::robot_platforms::SlamwareCorePlatform Athena =
20.             rpos::robot_platforms::SlamwareCorePlatform::connect(Athena_ip, Athena_port);
21.         //connect to the Athena
22.         rpos::robot_platforms::objects::CompositeMapReader cmapreader;
23.         //map reader
24.         rpos::core::Pose Athena_pose = rpos::core::Pose(rpos::core::Location(0, 0, 0));
25.         //the Athena pose in map(Athena_pose should be the Athena's real pose in new map)
26.         //using Athena.getpose() to get the old Athena pose
27.         auto map = cmapreader.loadFile(map_path);
28.         //load map
29.         Athena.setCompositeMap(*map, Athena_pose);
30.         //set compositemap
31.         rpos::core::Pose home_pose = rpos::core::Pose(rpos::core::Location(0, 0, 0));
32.         //the home pose in map(home_pose should be the home's real pose in new map)
33.         //using Athena.gethomepose() to get the old home pose
34.         Athena.setHomePose(home_pose);
35.         //set home pose
36.     }
37.     catch (rpos::robot_platforms::ConnectionFailException &e)
38.     {
39.         cout << "connect failed on " << e.what() << endl;
40.     }
41.     catch (rpos::system::detail::ExceptionBase &e)
42.     {
43.         cout << "failed on " << e.what() << endl;
44.     }
45.
46.     return 0;
47. }

```

Please refer to our SDK reference for more movement deployment.

Connect to Computer

Wired Connection

According to the requirements from actual application development, we have designed a RJ45 Ethernet port on the extended platform of Athena. Therefore, user can directly connect Athena to PC via network cable for extension or further development.

Wireless Connection

To help our user test Athena and meet the requirements in future actual application scenarios, Athena also supports wireless connection. User can connect to the SSID of Athena with a computer and then connect to Athena with its default IP address 192.168.11.1. In addition, user can use our Web Portal tool to distribute a specific IP address for Athena and use it for connection.

Debug Tools

RoboStudio

RoboStudio graphical tool is used for testing and controlling Athena. Please download it from our official website as below:

<http://www.slamtec.com/cn/RoboStudio>

In the same page, we also provide a document to introduce the usage of this tool.

Web Portal Tool

During developing, testing and controlling the SLAMTEC robots like Athena, our users can do many things to our robot via the Web Portal tool, such as checking basic information, upgrading firmware and configuring WiFi. (Default username: *admin*. Default password: *admin111*)

Our Web Portal currently supports the following features:

1. Check the information of the robot;
2. Restart the SLAMWARE module;
3. Upgrade firmware

Slamtec provides Athena firmware renewal and upgrade regularly. Our users can upgrade firmware via the Web Portal tool. Please ask for the latest firmware from our support engineers or sales representatives. The upgrade progress lasts for 5~10 minutes and the buzzer beeps during the upgrade process.

Athena will restart once the upgrade finished. Before that, please ensure that Athena has sufficient electricity.

4. WiFi configuration;
5. Start diagnosing SLAMWARE core;
6. Modify admin password;

For usage details, please refer to the following document:

<https://wiki.slamtec.com/display/SD/SQ001+SLAMWARE+Web+Portal+Function+Overview>

Charging and Battery

There are two ways to charge Athena battery.

Contact Charging

Athena has a charger supported automatically recharging. When the battery is lower than 30%(this value can be adjusted by the upper system according to actual requirements), Athena will find the charger by itself and start recharging automatically.

Manual Charging in Emergency

In some unexpected situations, like Athena cannot recharge itself temporarily, user can use emergency charging cable to charge Athena. The emergency charging port of Athena is shown in the following figure. Please use the emergency charging cable to connect the emergency charging port on the charger and the charging port on Athena.

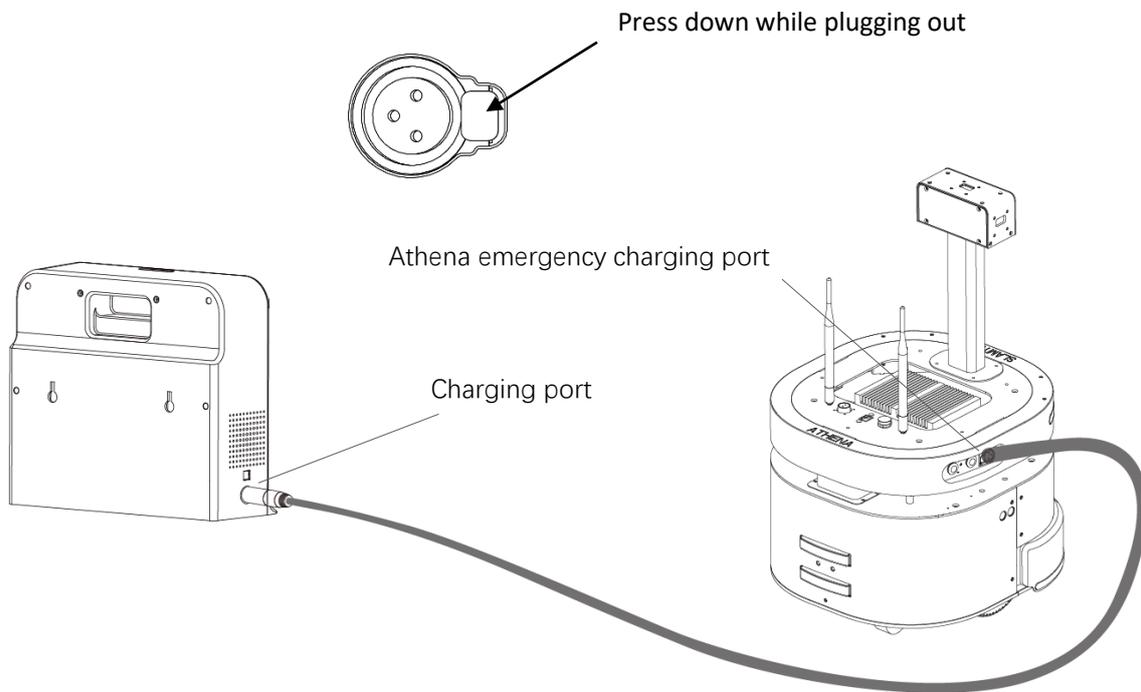


Figure 4-6 Manual Charging Connection

Battery Attention

Charging

Do not charge Athena or its battery with non-official charging devices.

The battery should be charged within the range of temperature specified in the products Specification. Stop charging immediately when the surface temperature of the battery is over 50°C.

Before charging, please ensure the polarities of the battery are connected properly. Reverse charging is strictly prohibited. Reverse charging cannot charge the battery. Inversely, it will induce fatal damage to the battery and even lead to battery heating, swelling, leaking, fire and explosion.

Storage

The battery should be stored in a cool and dry place. If you are intend to keep the battery for a long time (3 months or longer), it is recommended that the battery should be stored under the dry environment with temperature during 10-25°C and without corrosive gas. And the battery should be charged at least one time every six months to ensure the voltage of the battery is between 3.6V-3.9V.

Attentional Notes

Since the battery is softly packaged with aluminum foil, it is vulnerable to sharp objects. Please do not place the battery with sharp objects.

Do not fall, hit or bend the battery or it may lead to fire.

Do not disassemble the battery in any circumstances or it may cause internal short-circuit that results in swelling and fire.

Do not directly connect the positive and negative anodes of the battery or it may lead to fatal damage to the battery and even fire.

Do not put the battery into fire or it may cause danger.

Do not put battery into liquid, such as water.

Do not charge the battery in a car.

Avoid violent vibration, shock and pressing during the transportation of the battery and handle it gently when carrying it. The battery should be packaged and protected with soft packing material.

- Handle Athena base gently(do not kick, thrust or drag Athena).
- Do not spill any liquid on Athena.
- Do not use the recharging function of Athena when it is walking on a soft carpet which can sag more than 2cm.
- Ensure that Athena always starts on its charger.
- Do not change or replace anything in the machine without authorization.
- Ensure that the load of Athena meets the requirement of the specification.
- Do not use Athena on slope.
- Do not use Athena under environment with too many highly transparent materials.

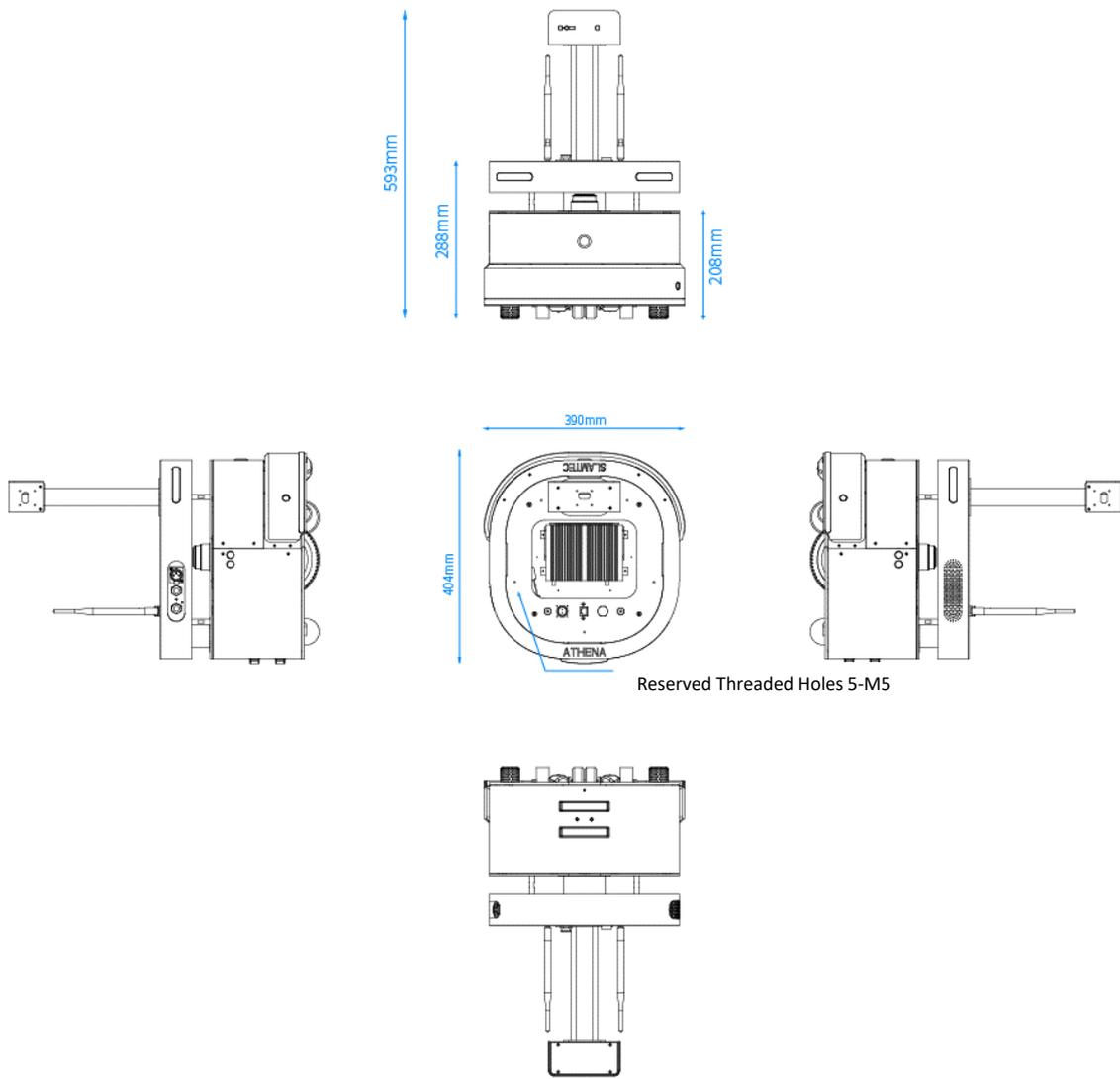


Figure 6-1 Athena Mechanical Dimensions

1. After receiving Athena, please check whether the package is in good condition and there is a checkmark on the box to shown it is Athena inside, as shown in Figure 1. If the whole package is intact and it is Athena inside, please cut the packing straps through and remove all of them, as shown in Figure 2.

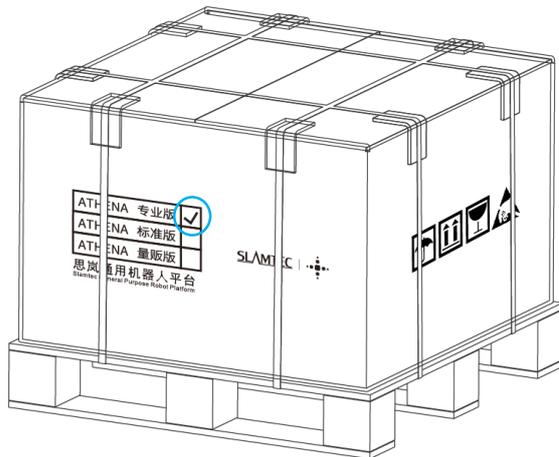


Figure 1

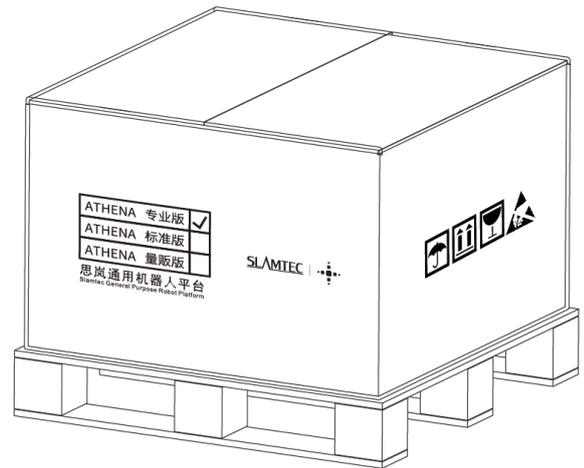


Figure 2

2. There is a mailing folder(with datasheet, quickstart inside) on the top of the box as shown in Figure 3, please take it out and keep it well. Remove the packaging tape on the top of the box and then open the box. As shown in Figure 4, there are the depth camera module, the depth camera holder, two Wi-Fi antenna and the bolts to assemble the above parts. Please take them out and put aside.



Figure 3

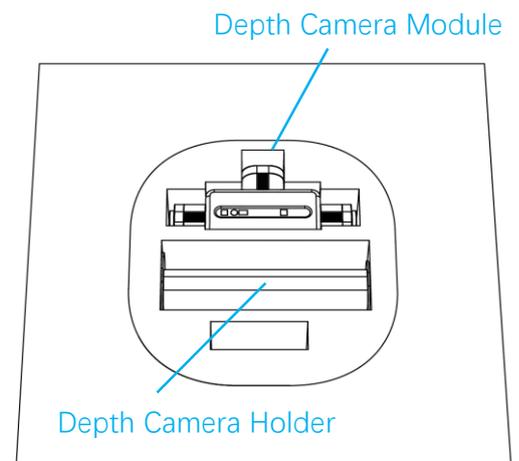


Figure 4

3. As shown in Figure 5, please carefully take out the EPE for fixing the depth camera from the box and then take out the depth camera module from the EPE.

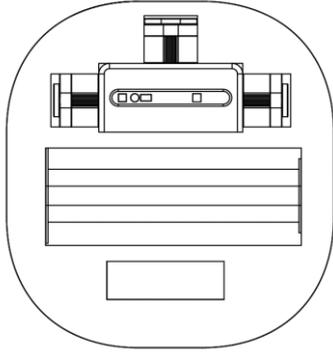


Figure 5

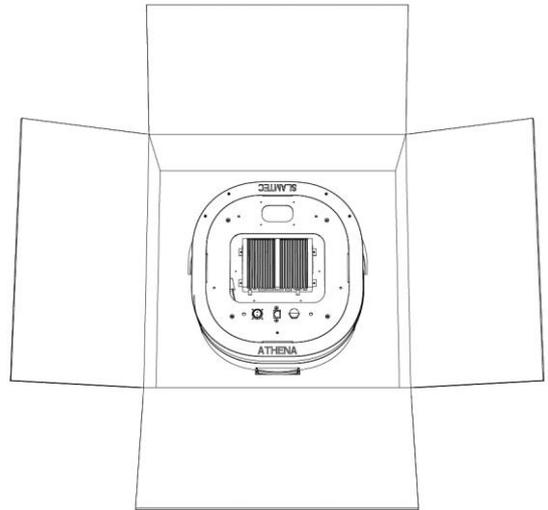
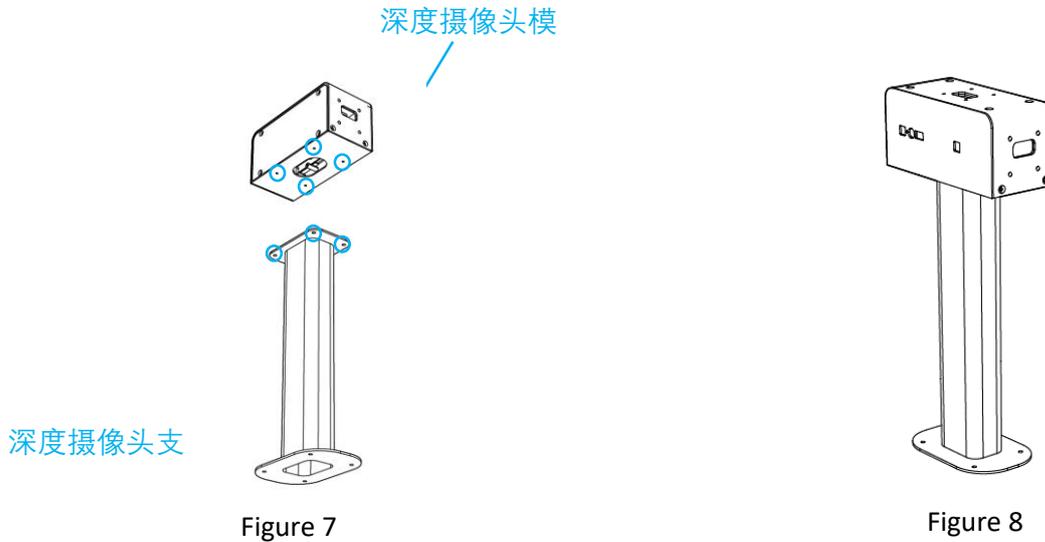


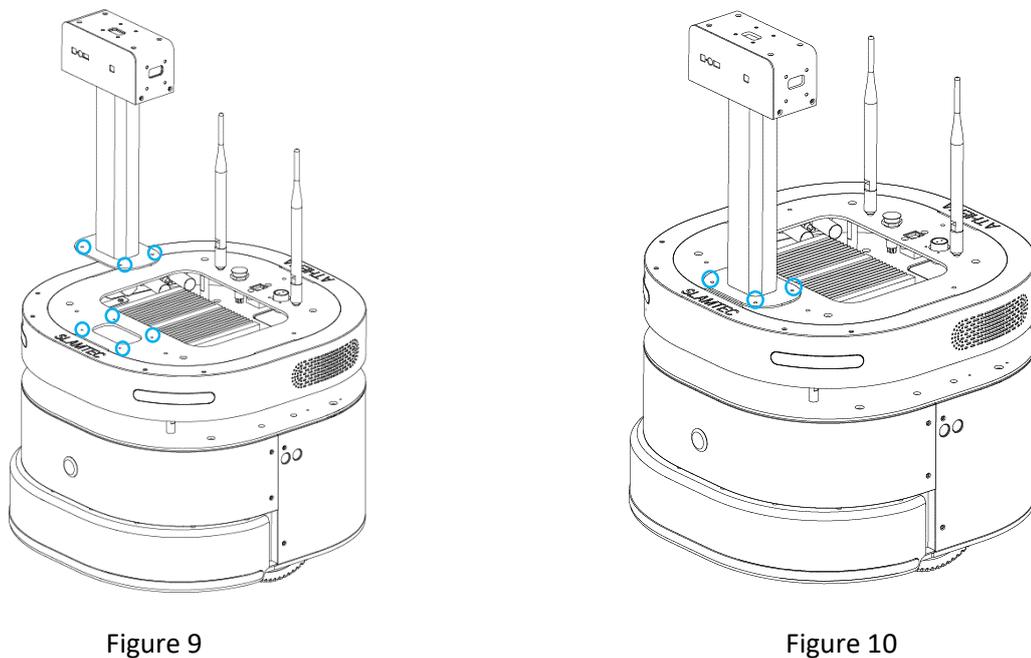
Figure 6

4. After removing the top EPE, please take out the Athena carefully with the help from at least one of your colleagues. Next, you need to install the depth camera on the top of the robot.

1. As shown in Figure 7, there are the depth camera module, and the depth camera holder. As shown in Figure 8, please connect the depth camera module to the depth camera holder and fix them with four M3*5 screws (in the blue circled screw holes of Figure 7).



5. As shown in Figure 9, fix the above depth camera holder on the top side of Athena with four M3*5 screws (in the blue circled screw holes of Figure 9). And then connect the USB cable of the depth camera module with the IPC(the blue USB interface of the IPC) on the tope of Athena.



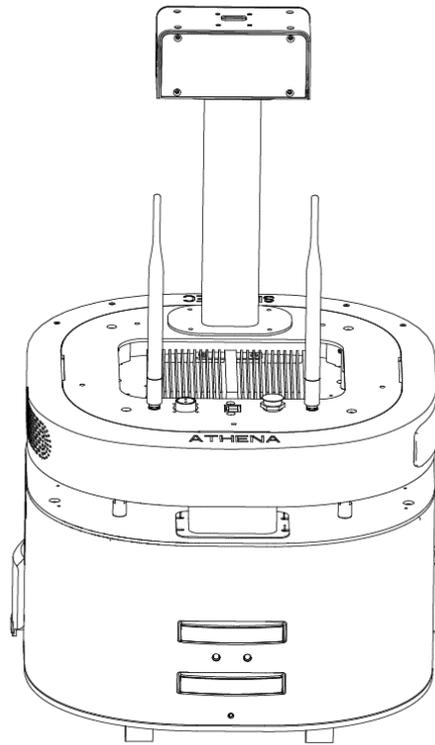


Figure 11

1. As shown in Figure 11, the side with charging electrodes is the back cover of Athena and you need to take it down to put battery in. And you can start from removing the blue circled M3*8 screws in Figure 12, there are four M3*8 screws in total. And then you can remove the whole Athena back cover from Athena as shown in Figure 13.

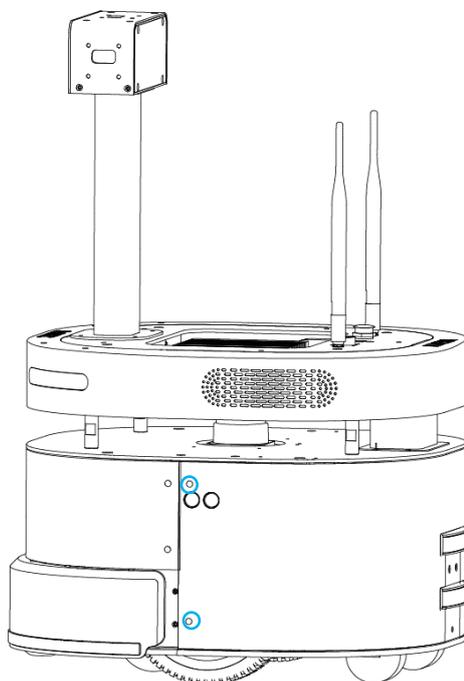


Figure 12

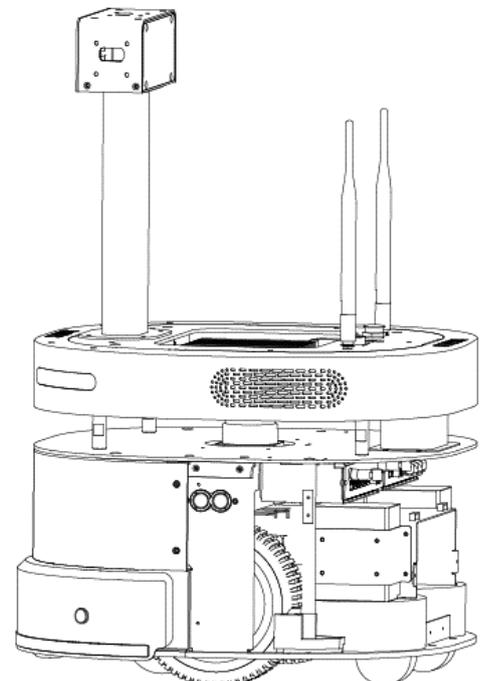


Figure 13

- As shown in Figure 14, unscrew the four blue circled M3*5 screws and remove the battery lid, the battery is shown as in Figure 15.

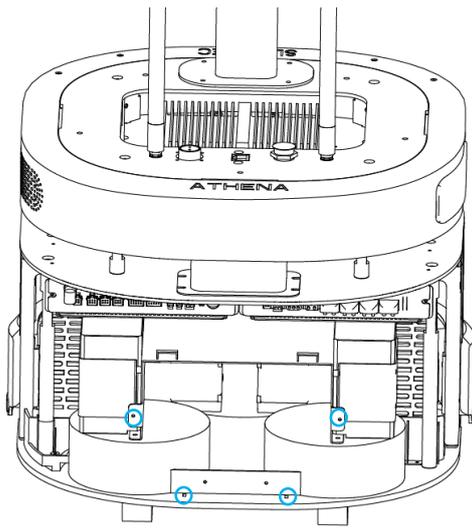


Figure 14

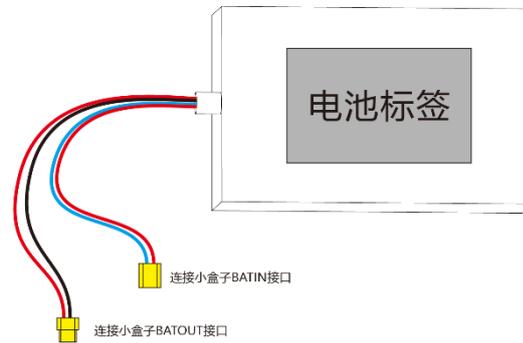


Figure 15

- As shown in Figure 16, carefully put the battery into the battery holder with the mark side up. And the connect the cables between battery and Athena (the black cable is connected to the air switch and the blue cable is connected to the BATIN interface of the power management module), as shown in figure 17.

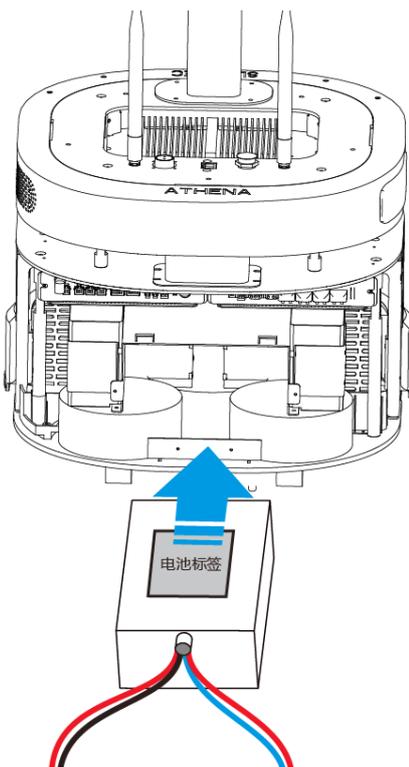


Figure 16

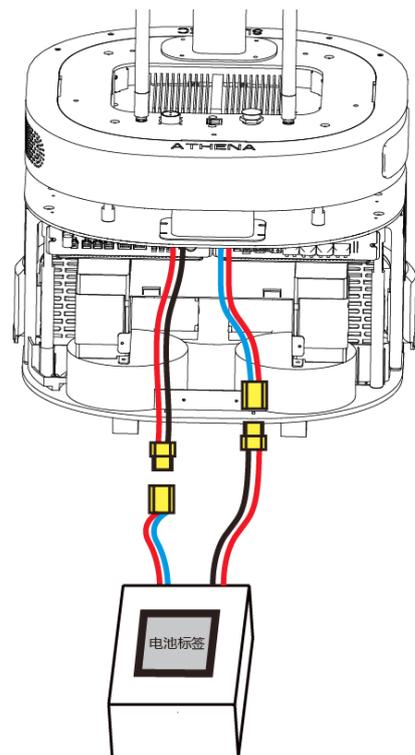


Figure 17

- As shown in Figure 18, please tidy the cables.

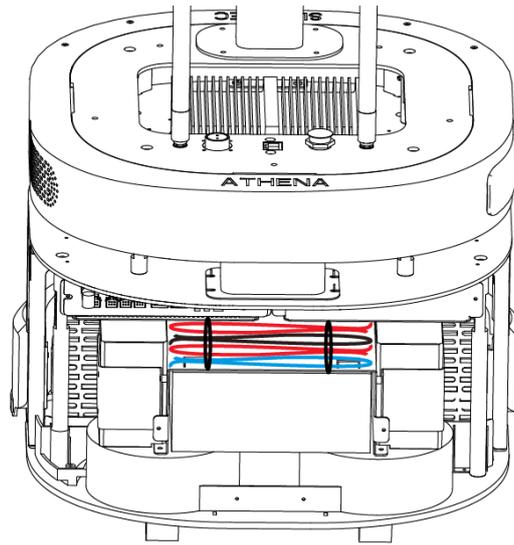


Figure 18

5. Please install the Athena back cover back to the Athena to finish the whole installation.

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