# ROSYZ-01B Robot Platform

# USER MANUAL

*Rev: 2.0(Dec 2019)*

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# §1 Brief Introduction

## §1.1 ROSYZ-01B Basic Information

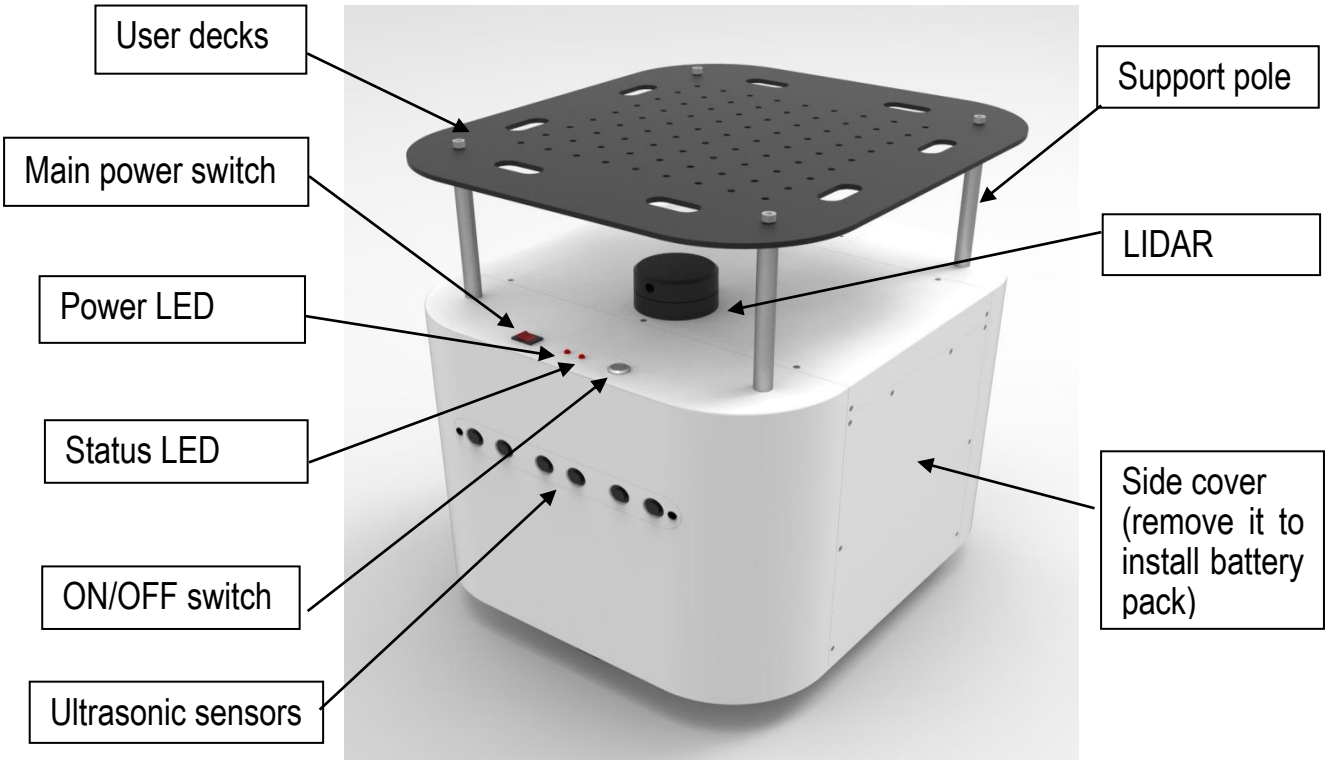
ROSYZ-01B robot platform is a two wheel differential and large load robot motion chassis platform based on ROS architecture. It is very suitable for college students some enterprise R & D engineers.

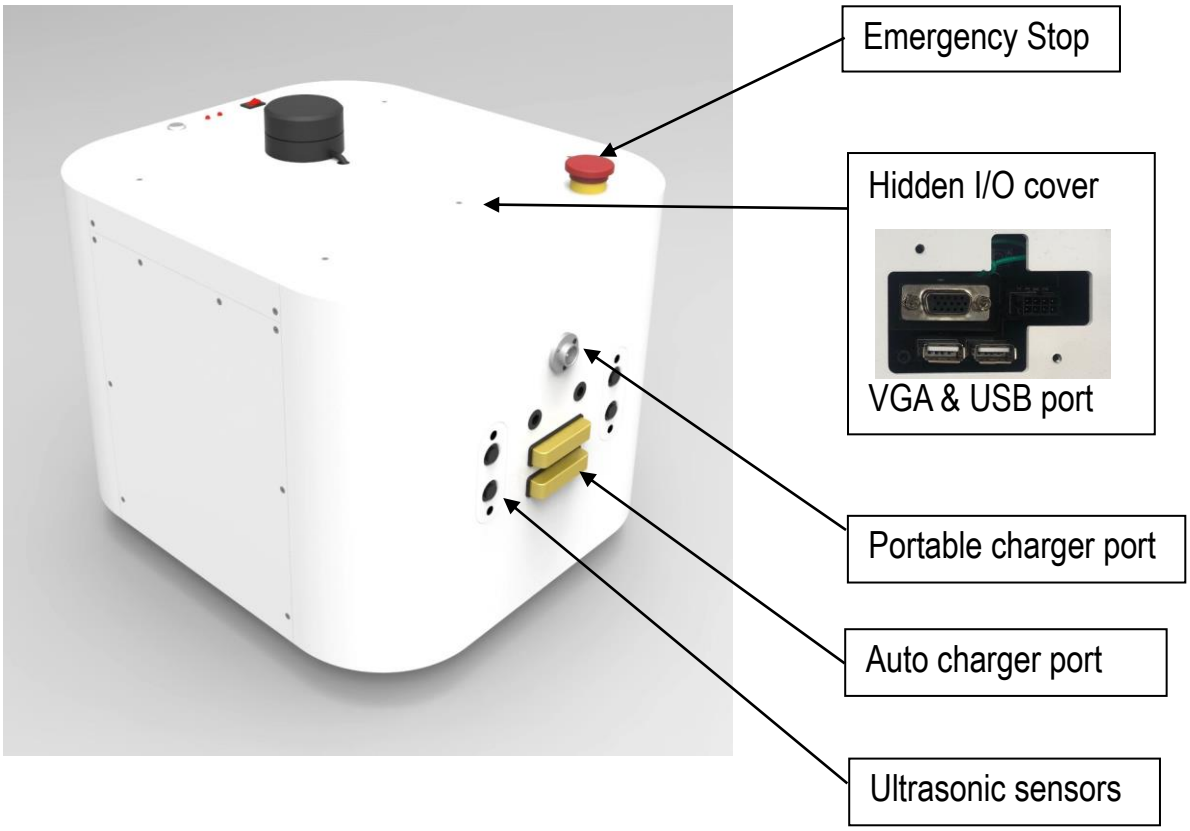
The chassis platform is an integrated hub motor with high efficiency and high load. The platform can load up to 50KG, and the maximum walking speed can reach 0.7 meters per second. ROSYZ-01B's built-in DCDC power conversion module can provide four different voltages of 5V, 12V and 24V, which can basically solve the power supply problems of various sensors that the robot needs to carry. In order to facilitate developers to do in-depth research, the ROS platform motion control board and DCDC power board circuit diagram and detailed interface drawings we also provide.

This YZ-01B ROS platform has built-in Intel i5 CPU industrial personal computer, installed Ubuntu 16.04 O/S and ROS Kinetic packages. YZ-01B also has ultrasonic wave sensors which can provide basic obstacle avoidance. As optional parts, we provide auto charging dock and LIDAR for real applications.

At the same time, like other ROS platform robots, ROSYZ-01B provides open source basic ROS application examples and basic motion driven node programs that allow developers to use it very easily.

## §1.2 Main parts of ROSYZ-01B






**LED status indictors:**

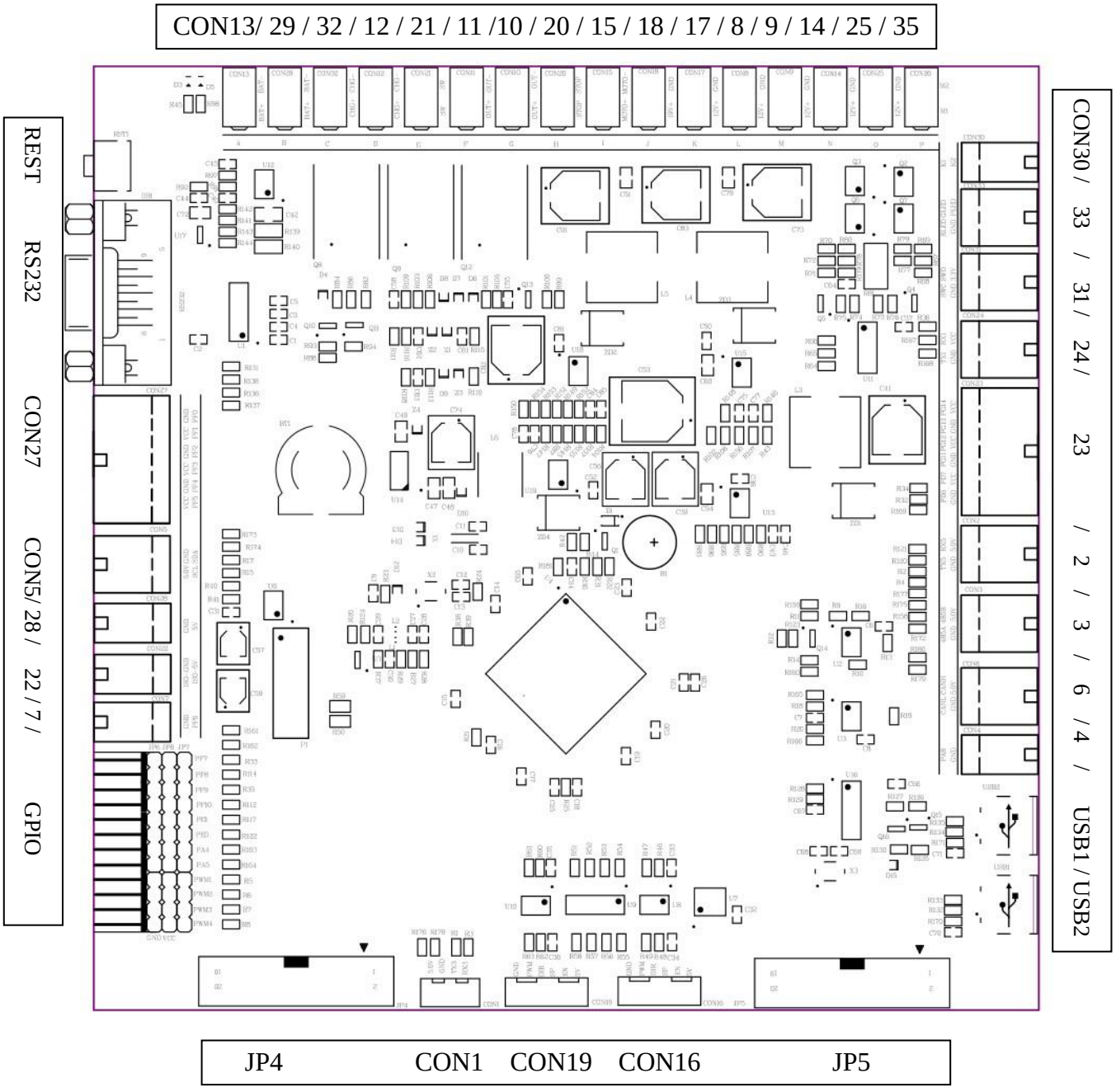
Power status: RED for POWER ON

Operating status: RED solid: Charging now

GREEN flashing: normal working

RED flashing: low battery

## §1.3 ROSYZ-01B Control Board connectors definition



## Connectors Definition:

Power ports

| | |
|---|---|
| CON13 | Battery input(24V) |
| CON29 | Battery input (24V) |
| CON32 | Charger input |
| CON12 | Charger input |
| CON21 | Power switch |
| CON10 | Battery output (24V) |
| CON11 | battery output (24V) |
| CON20 | Emergency stop switch |
| CON15 | Motor power output |
| CON18 | +19V output |
| CON17 | +12V output |
| CON8 | +12V output |
| CON9 | +12V output |
| CON14 | +12V output |
| CON25 | +12V output |
| CON26 | +12V output (isolated) |
| CON28 | +5V output |
| CON22 | +5V output (isolated) |

Communication and others

RS232 UART port

CON27: Front ultrasonic sensors

CON5: NA

CON7:NA

CON30: ON/OFF button

CON33: LEDs display board

CON31: SWD

CON24 : NA

CON23: Back ultrasonic sensors

CON2: TTL RS232

CON3 :NA

CON6: NA

CON4: NA

USB1: USB debug

USB2:NA

JP4: NA

JP5: NA

CON1: NA

CON19: Left wheel driver

CON16: Right wheel driver

JP6, JP7,JP8: GPIO

JP6: GND

JP8: VCC

JP7:

PF7: power on signal

PF8:NA

PF9,PF10: Auto charging guide signal

PE0,PE1: NA

PA4,PA5:NA

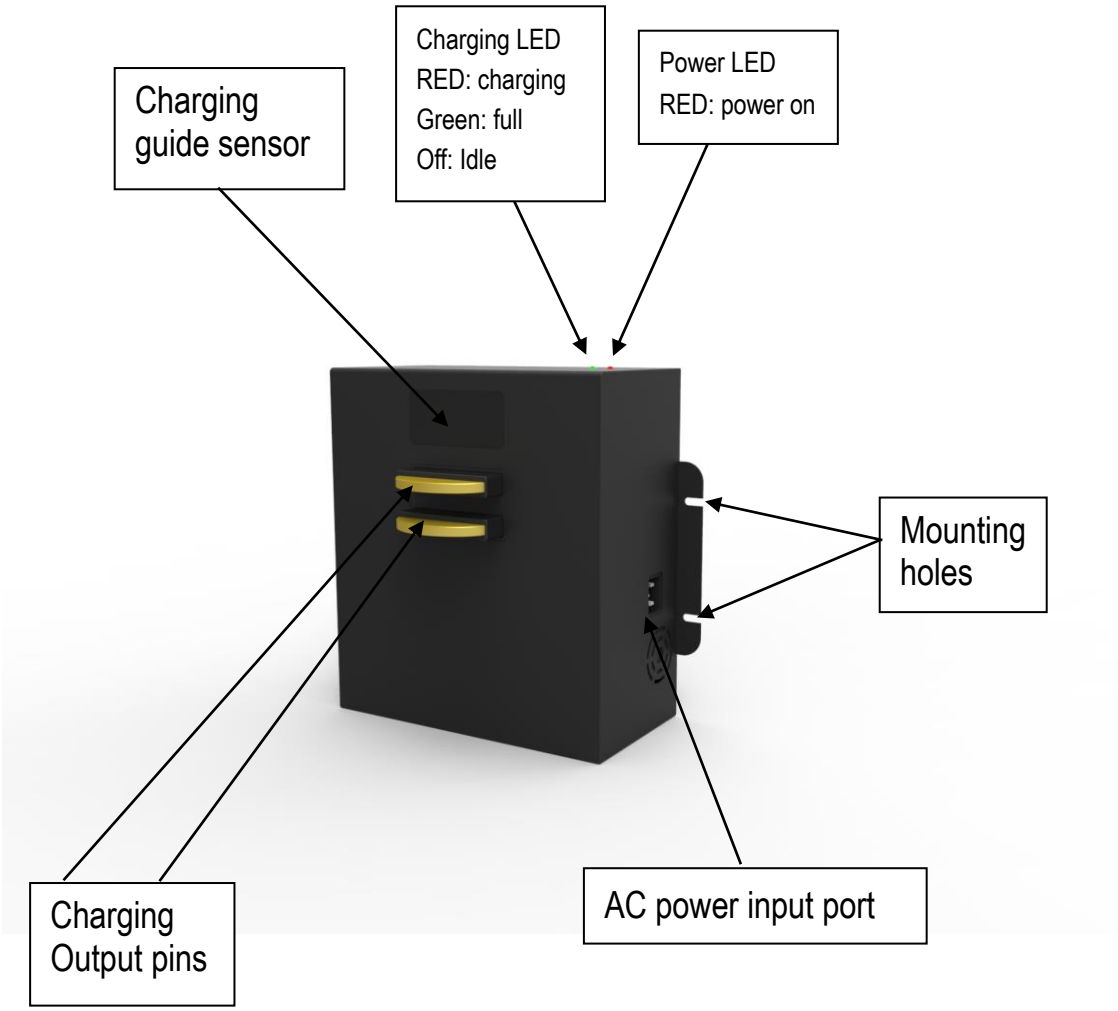
PWM1,PWM2: NA

PWM3:NA

PWM4:NA

## §1.4 Auto Charging dock (Optional part)

ROSYZ-01B Auto charging dock profile




Installation guide： Please put this charging dock against a flat wall, make sure the front of charging dock is empty enough (> 2.0 meters @ 120°), without any obstacle in this area.

## §1.5 Software installed on the robot computer

ROSYZ-01B has Intel i5 CPU personal computer and pre-installed following items：

1. LINUX ： UBUNTU 16.04, **user name: robot; password: 1**
2. ROS basic ： KINETIC FULL-DESK
3. ROS application packages(under “ws” folder) :
   - 3.1 STM32_CONNECT （platform drivers and communication）
   - 3.2 ROBOT_MSGS （YZ01B special message）
   - 3.3 YDLIDAR （Optional LIDAR package from EAI）
   - 3.4. MIIBOO_IMU（Optional IMU package from Miiboo）
   - 3.5 RBX1_NAV （SLAM and navigation demo）

## §1.6 ROSYZ-01B sensors installed:

ROSYZ-01B pre-installed sensors list (include optional parts)

1. Ultrasonic wave module: DYP-ME007YY V2.0
2. Mechanical safety strip.
3. LIDAR (Optional part, required by user)
4. Auto charging dock (Optional part, required by user)
5. IMU module (Optional part, required by user)
6. Wireless keyboard and mouse (Optional part, required by user)
7. Wireless joystick (Optional part, required by user)

## §1.7 ROSYZ-01B default packing list(not include optional parts)

| Item | qty | unit | Remark |
|---|---|---|---|
| Main platform | 1 | set | No battery and decks |
| User decks | 1 | pc | |
| Support pole | 4 | pc | |
| Battery Charger | 1 | pc | P/N: L200CM-24F8 |
| AC power cord | 1 | pc | Europe type plug |
| M4 Screw | 5 | pc | |
| Screwdriver | 1 | pc | For M4 M6 screw |
| DCDC cable | 1 | set | 8 wires, 10~20cm |
| ROS SDK and Demo | 1 | set | Free download |
| User Manual | 1 | pc | PDF format |
| LiFePO4 BATTERY | 1 | pc | 25.2V14Ah |

# §2 How to use

## §2.1 First of first

The ROSYZ-01B robot platform is designed for ROS robot developers. Operators must have the basic knowledge of ROS robots. Please read through this manual before using it, especially read the “Cautions” on the next page carefully.

## §2.2 Using step by step

### 2.2.1 **Check the completeness of the accessories：**

Open the packing cartons of the robot, take out the ROSYZ-01B robot movement chassis and all parts, and check the packing list, check whether there are leakage and wrong loading.

### 2.2.2 **Install battery-pack and decks**

For transportation safety, the battery pack and the body of the ROSYZ-01B robot are individually packaged. Before using, please install the battery firstly.

Remove the side cover and put the battery-pack onto the chassis. Then plug the battery-pack plug into “BAT” connector in the cabin.

### **2.2.3 Switch power on**

Main switch is on the back side of top cover, see Page 2. After turn on it, the power LED will be RED solid; then push the ON/OFF button, the operating status LED will be flashing GREEN.

If the power LED is not lighting after main switch closed, please check the battery voltage is good or not. For some reason, when you found the battery voltage is <= 20V, please plug in the portable battery charger and charge the battery at least 3 hours, then try again. The portable charging port and auto charging dock terminals are all on the rear cover of robot

### 2.2.4 **Connect the robot into your field Wi-Fi.**

See page-2, use screw driver to remove the cover of VGA&USB connector port，insert keyboard/mouse and VGA monitor, then power on robot and chose your Wi-Fi SSID and set password, let robot computer connect into your net system. We suggest you should give this robot a fixed IP address (do it from your LAN router). The default login password of robot PC is 1.

Caution: when you want to run robot, please firstly unplug any cables which is connected with your desktop device (such as VGA monitor).

2.2.5 Install a joystick driver when necessary. (Optional part).

If you want to drive your robot from joystick (for example, when you run gmapping function), please insert the joystick receiver USB part into the robot computer USB port.

Please note, it your joystick is not the ROS official website recommended model, please install the joystick ROS driver package firstly.

## §2.3 YZ-01 ROS demo instruction:

### 2.3.1 Do gmapping SLAM to generate a map of your office:

1）**Preparing work:**

**Your desktop PC is ready:** Please make sure your desktop or laptop PC was installed ROS KINETIC. Otherwise, please install ROS on your PC firstly. Then copy the rbx1_nav source folder from robot PC to your desktop PC ROS work space src folder, and then on your desktop PC run catkin_make command to compile this rbx1_nav package;

**YDLIDAR is connected;**

**Joystick is connected;**

2）**Run gmapping command on your robot PC**.

Use SSH command to open a SSH terminal (password is 1) from your desktop PC to remote login robot PC, and then launch:

*$ roslaunch stm32_connect start_basecontrol.launch*

*$ roslaunch rbx1_nav yz_gmapping_by_ydlidar.launch*

You can look over the gmapping_ *by_ydlidar.launch* file and learn more details about this launch command.

3）**Run RVIZ on your desktop PC ternimal**

Due the running robot has not a monitor and SSH can not provide graphical remote login, so we need run RVIZ on your desktop PC instead. Before run RVIZ, please let your desktop PC's ROS MASTER redirect to robot PC ROS core:

*$ export ROS_MASTER_URI=http://robot IP:11311*

*$ rosrun rviz rviz -d `rospack find rbx1_nav`/gmapping.rviz*

If everything OK, you can see some map pixel on the screen.

4) **Drive robot moving and save map data on your robot PC**

Use joystick to drive robot slowly walking around your office, until all roads are covered. Then stop robot.

Use SSH to remote login robot PC from your desktop PC, then

*$ rospackcd rbx1_nav/maps*

*$ rosrun map_server map_saver -f my_map*

"my_map" the name of this new map. You can find this new map files in rbx1_nav/maps folder.

2.3.2 **Use standard move_base and amcl to run robot from where to where**

1) I suppose you have just finished gmapping demo, and get a new map named “my_map”.

2）**Run move_base and amcl command on your robot PC.**

Use SSH command to open a SSH terminal from your desktop PC to remote login robot PC, and then launch the following command:

*$ roslaunch rbx1_nav yz_demo_move.launch map:=my_map.yaml*

You can look over the yz_demo_move.launch file and learn more details about this launch command.

3）**Run RVIZ on your desktop PC ternimal**

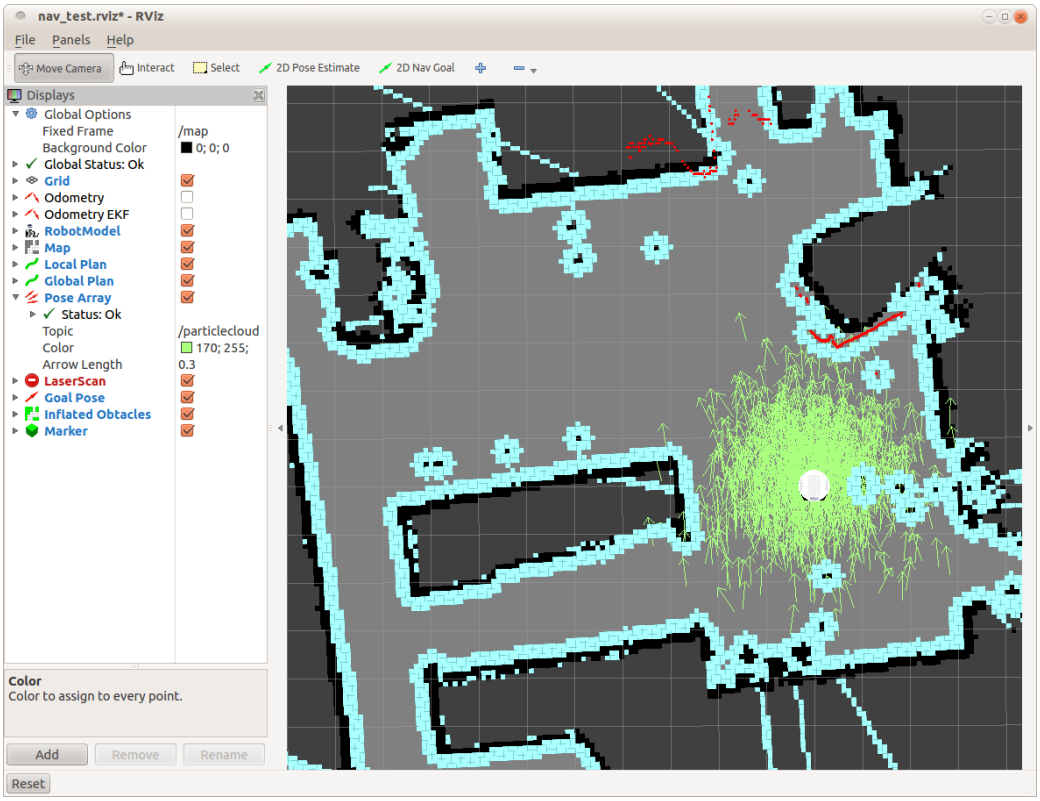
Before run RVIZ, please let your desktop PC’s ROS MASTER redirect to robot PC ROS core:

$ export ROS_MASTER_URI=http://robot IP:11311

*$ rosrun rviz rviz -d `rospack find rbx1_nav`/nav_test.rviz*

Use <2D Pose Estimate>to initial robot pose at beginning.

Use <2D Nav Goal> to assign a new target for robot to reach.



# §3 CAUTION

3.1 **Pre charging**: before running the robot for the first time, please charge battery at least 3 hours. For the transportation reasons, the battery before shipping only has very little electricity.

3.2 **Charge temperature:** pay special attention to charging at room temperature of 0~30 degrees Celsius. High or too low ambient temperature can damage the battery!

3.3 **External power interface:** please connect the external battery and output DCDC power strictly according to the pin position and polarity of the power supply interface. The wrong wiring will damage the interface board or other devices. Make sure that the maximum current used by the device does not exceed the limited current value of the DCDC board.

3.4 **Troubleshooting:** if the robot is in the use of abnormal function, please try to turn off the power, and then restart, in general, the robot will be restored to normal, if restarted, the robot can not be used normally, please notify the technical service personnel for remote guidance.

3.4 **Emergency issues:**

When the robot walks abnormal, please press the red emergency switch!

When the robot or charger has smoke, please turn power immediately!

When the robot is in serious collision or fall accident, turn off the power!

# §4 ROSYZ-01B Datasheet

| | |
|---|---|
| Move base size | 45X40X37 cm |
| Move base weight | 22KG(not including battery) |
| Move drive mode | two-wheel differential |
| Battery required | 24V14AH LiFePO4 battery-pack |
| Motor type | 24V wheel-hub motors |
| Inside Computer features | CPU: Intel® Core™ i5-3470T processor<br>RAM: 4G<br>Storage Disk: 500G<br>I/O : USB2.0*4, VGA, Microphone/headset port, DP, RS232<br>Ethernet: Integrated 100M/1000M Ethernet<br>Wireless: 802.11b/g/n Combo (WLAN+BT) |
| DCDC provided | 5V2A、12V2A、19V4A |
| Move speed | 0.1-0.7 m/s |
| Maximum load weight | 50KG |
| Externa charger | 29.4V6A smart charger |
| Auto charging guide | Optional |
| Control Board | STM32F10X ARM chip |
| Emergency stop | Push RED button |
| Upper layer height | 15CM |
| Hardware data provided | All electronic schematic drawings are provided |
| ROS diver provided | Provide ROS node binary file which can output each wheel's ticks and accept setting speed value |
| ROS demo | Provide a basic keyboard remote control moving demo application. C++ source code of this demo is used. |

# Appendix A: ROS Topics of YZ robot diver node

1. Firstly, launch robot diver node:

   roslaunch stm32_connect start_basecontrol.launch

2. Topics of robot diver node

   2.1. **Topic name: "Auto_Charging**", function: to enable or disable auto-charging flag

   Topic value: auto_charging_flag = 0: Disable = 1:Enable

   【Example】: in a terminal , input following text:

   rostopic pub /Auto_Charging robot_msgs/Charging_Control "auto_charging_flag:1"

   Above instruction will let robot go to charging dock automatic

   2.2. **Topic name："PMS_get_status**", check battery power level and status

   Topic value: pms_charging_flag = 0: now not charging = 1: now charging

   Pms_battary_level = n : means battery power level is n% remain

   【Example】: in a terminal , input following text:

   rostopic echo /PMS_get_status

   Above instruction will display battery status and remain capacity level

   2.3. **Topic name："Ultrasound_result"** , check ultrasonic obstacle sensor trigger status

   Topic value: cs_obs = 0：none obstacle =1：front obstacle

   =16：rear obstacle =17：front and rear obstacles

   【Example】: in a terminal , input following text:

   rostopic echo /Ultrasound_result

   Above instruction will display ultrasonic obstacle sensor status

   2.4. **Topic name："Wheel_Switch" ,** check emergency switch status

   Topic value: Switch = 0：Pushed(Enable) =1：Release(Disable)

   【Example】: in a terminal , input following text:

   rostopic echo /Wheel_Switch

   Above instruction will display emergency switch status

   2.5. **Topic name："cmd_vel"** , check or set the linear/angular velocity

   【Example】: in a terminal , input following text:

   rostopic pub /cmd_vel geometry_msgs/Twist "linear：

   x:0.3 y:0.0 z:0.0 angular: x:0.0 y:0.0 z:0.1"

   This will let robot run at 0.3m/s linear and 0.1r/s angular velocity

   2.6. **Topic name："odom"** , check odometry data

   【Example】: in a terminal , input following text:

   rostopic echo /odom

   Above instruction will display odometer data