DSR02B Indoor Delivery Robot

USER MANUAL

Rev: 3.1 (Nov, 2020)

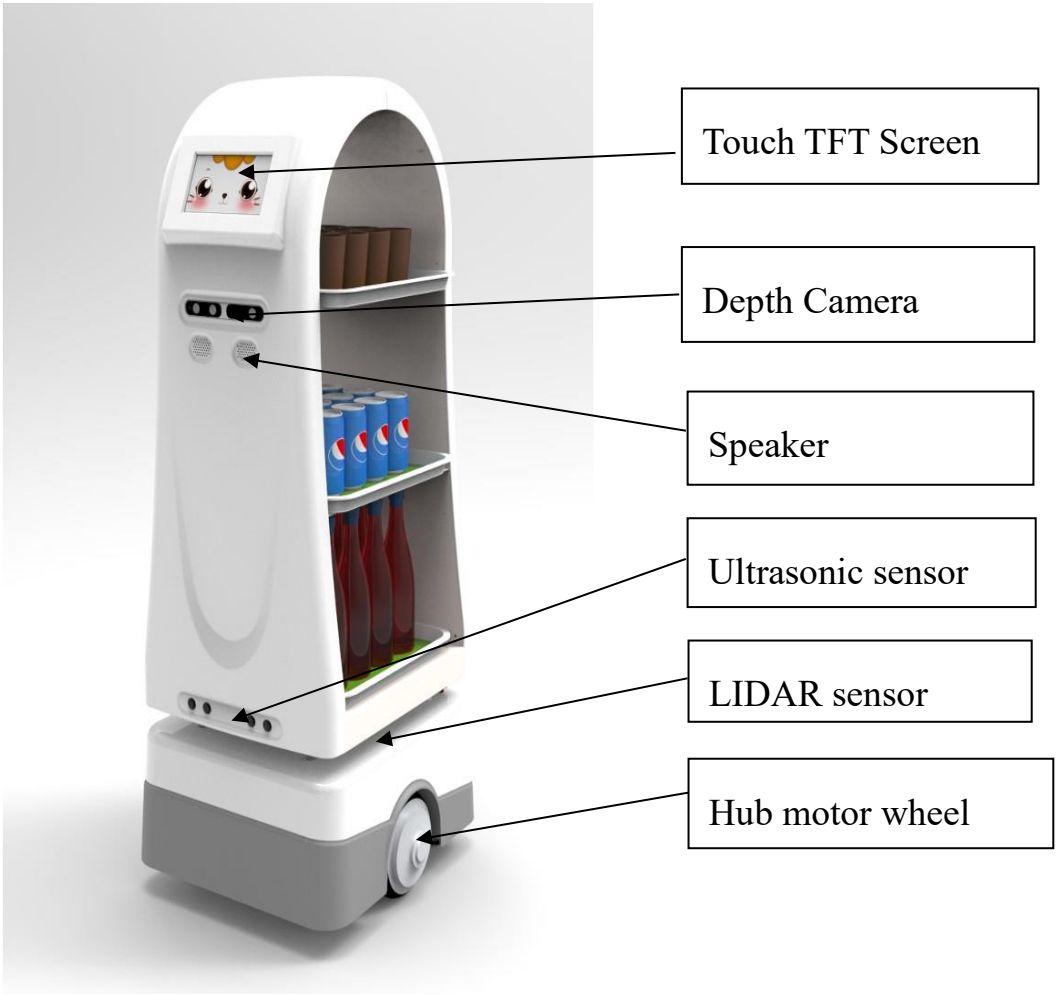
§1 Brief Introduction

§1.1 DSR02B features

DSR02B indoor delivery robot are designed for restaurant, hotel and hospital delivery service. DSR02B have six-wheel elastic chassis, 125cm in height, 30KG in payload, three independent 40X40X30cm storage boxes or three tray-layers. With waterproof splash design, LIDAR and computer-vision do mapping, navigation and obstacle avoidance. It can be equipped with 3rd party elevator control module, gate access control and other third-party security modules, which can freely and accurately access the gate, automatic door, elevator and so on.

DSR02B indoor delivery service robot can walk remotely or according to a predetermined fixed route; can configure front-end camera AI algorithm (face recognition); equipped with automatic charging dock. It can automatically return to charging dock after work, to achieve uninterrupted work for 7X24 hours.

§1.2 DSR02B front parts



§1.3 DSR02B rare parts

Emergency Button

Auto charger guide sensor

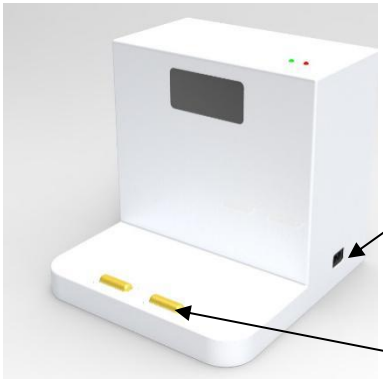
Main power switch

Auto charger poles (on robot's bottom)

Portable charger port

Upper LED
Red solid: charging
Red flash: low battery
Green solid: charged
Green flash: running

Upper LED
Red solid: power on



Charger AC input port

Charger poles

§1.4 DSR02B default packing list

item	qty	unit	remark
Robot body	1	set	
Battery charger	1	Pc	
Auto-Charging dock	1	Pc	
Remote Joystick	1	Pc	
AC power cord	1	Pc	
Operating software	1	set	.exe file for Windows o/s
User Manual	1	Pc	PDF format

§1.5 Special Notice

"DSR02B user manual" is compiled for the standard configuration. In the real application filed, it is necessary to adjust the hardware and software of the MR9 robot according to the user's specific site conditions and equipment distribution before it can be put into use.

Please contact YZ Robot Tech Co. Ltd salesman before using.

§ 1.6 Auto charging dock (Optional part)

If you purchased auto charger dock, please install this charger dock to a fixed location, against a back wall. Make sure the charger dock ahead is a open space (at least 2 meter free space.

Generally, this charger dock location should be set as “Home Station”, This “Home Station” is very important for robot running. To set the coordinate for this “Home Station”, please see § 2.4 section.

§2 How to use

§2.1 Note before use

DSR02B robot is a professional automatic intelligent equipment, which can only work in specific working environment. Before using, please be sure to complete three training courses: “map construction”, “network configuration” and “client software guidance”. Without the permission of YZ Robot Tech Co Ltd’s technical personnel, modifying the relevant hardware or software configuration of the robot may cause safety accidents and unnecessary economic losses.

§2.2 Create a map of your site

In an unfamiliar environment, DSR02B needs to be built a 2D space occupying map when it is first used. The relevant technical personnel of the client should build the map in strict accordance with the robot operation manual. After the map construction is completed, you should assign the “Home Station” and all tables coordinate.

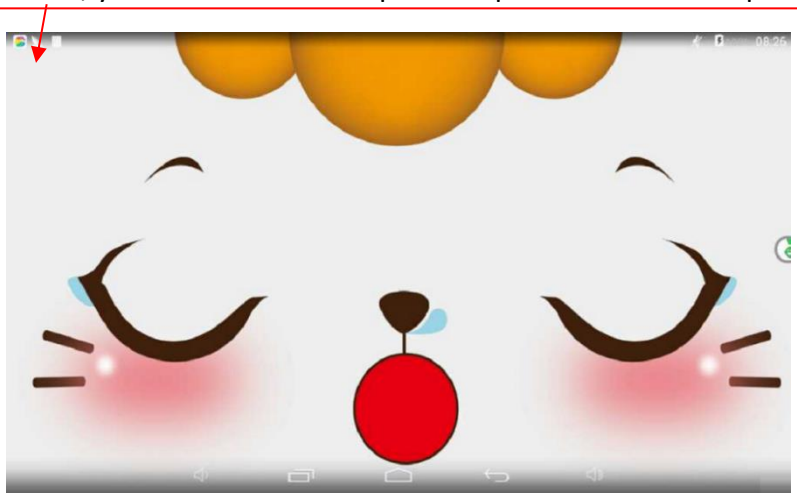
Please refer to Section 2.4 for details.

§2.3 Normally use for deliver food/goods

2.3.1 Power on robot when robot at “home station”. Generally this home station is the robot charger dock station or the food counter center.

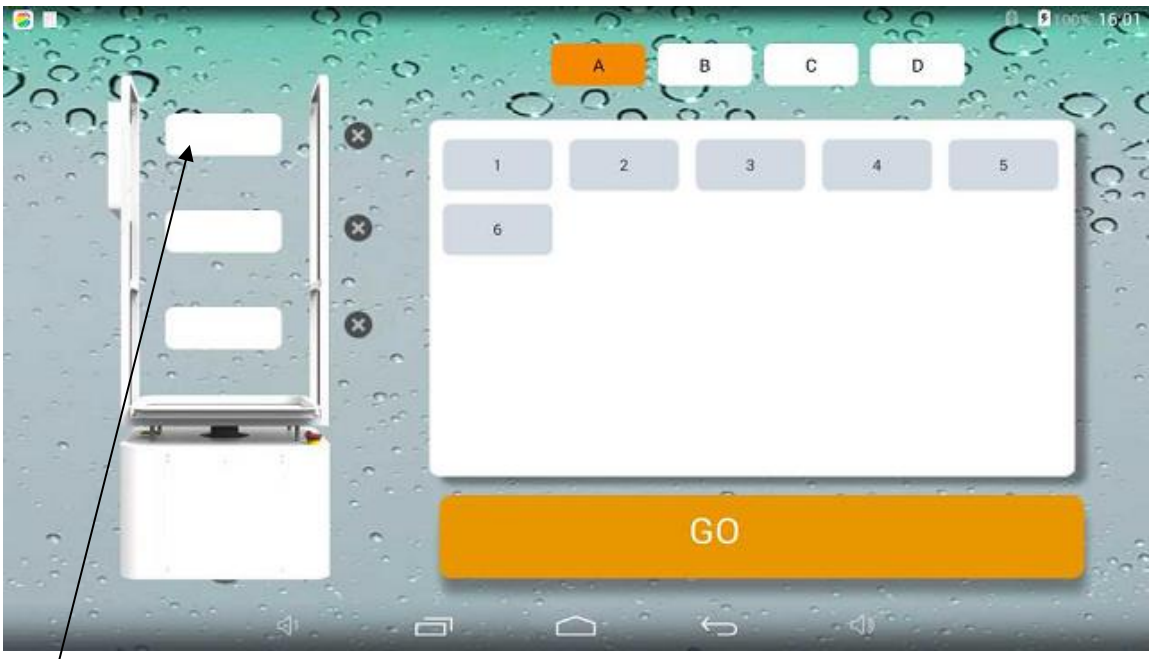
2.3.2 After robot power on successfully, you will find following screen.

Here is a hidden button (in the upper left corner of the screen).
click it, you can enter to set up the map and set the table position



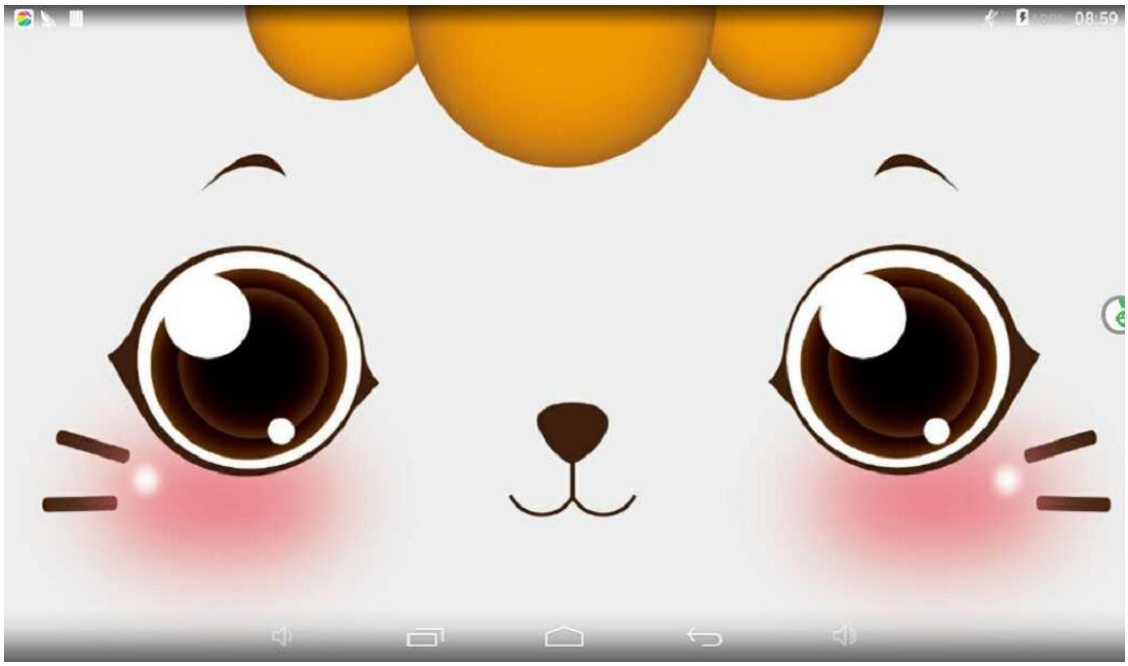
Cat face sleep means standby mode
Click on the cat's face to enter the delivery task mode

2.3.3 Click on the cat's face to enter the delivery task mode， as following screen

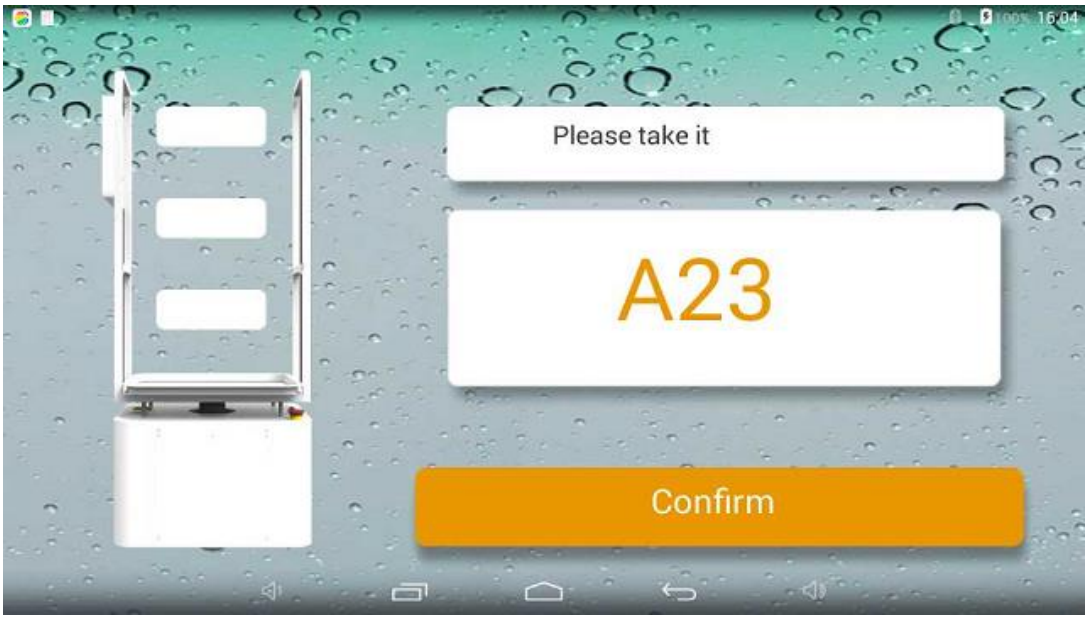


Select table name (“1”, “2”…) and shelf (up, middle, lower), add this to task list, After assign all tasks, press “GO” , the robot will auto run according task list

2.3.4 After press “GO”, robot screen will be a living cat face, as following



2.3.5 When robot arrive task site and stopped, please take the food out, then press ”Confirm” button, robot will go to next task site. After all task were done, robot will auto go back to “Home Station”

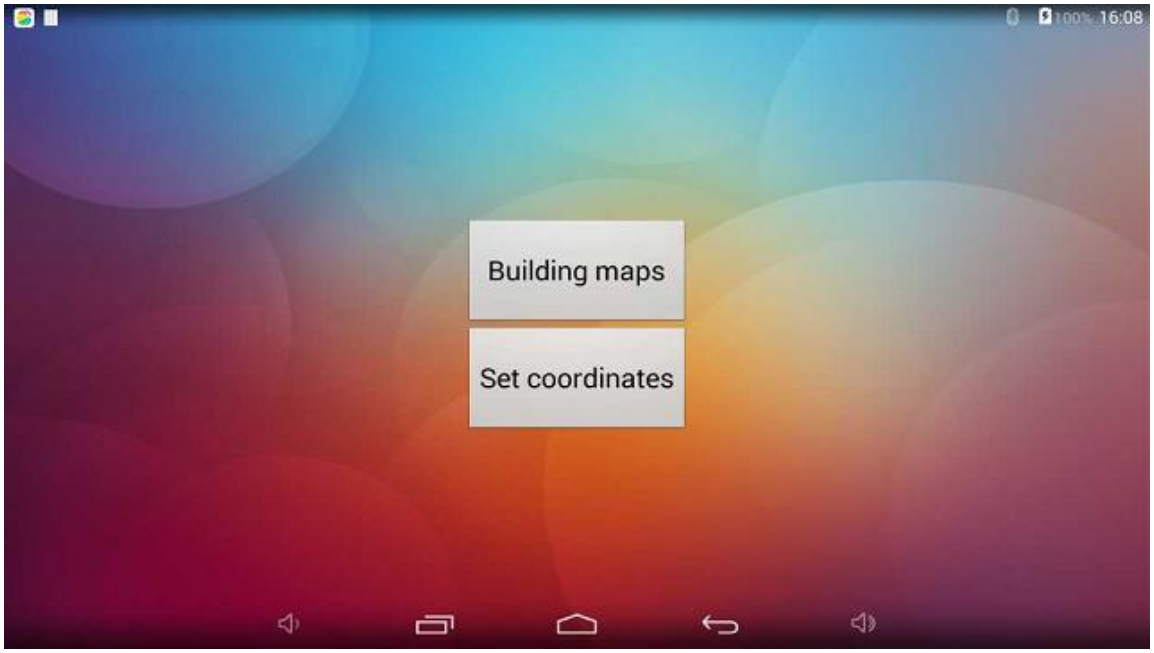


§2.4 How to build a new map and assign the coordinate for “Home Station” and tables

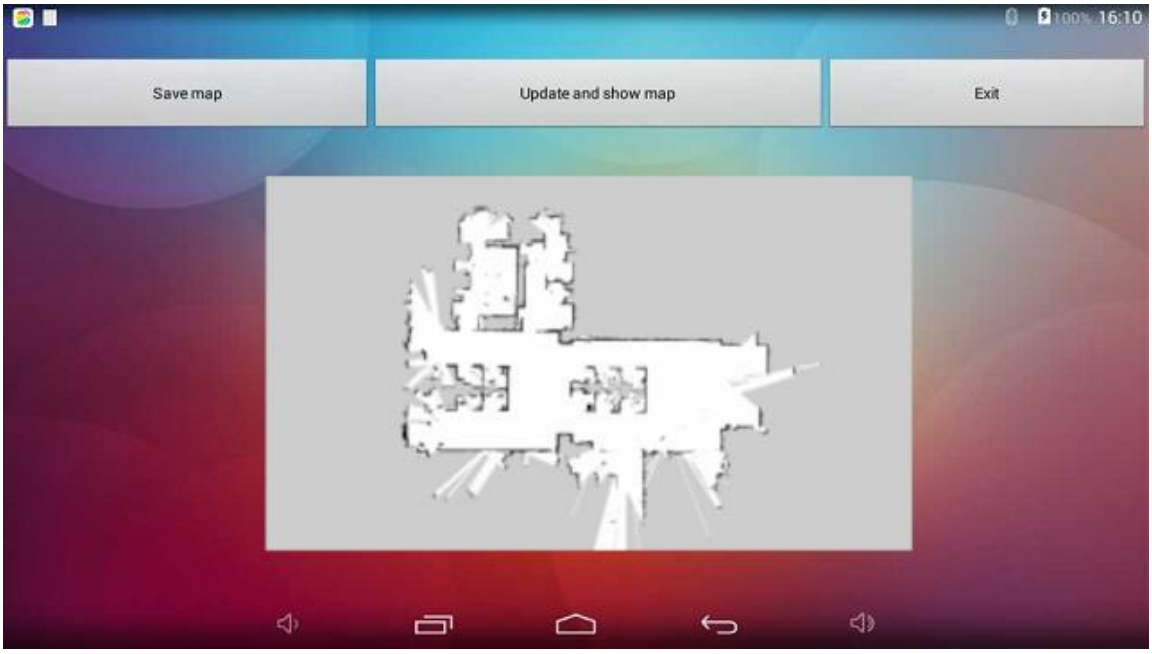
See page 5, § 2.3.2 photo， click the hide button (in the upper left corner of the screen) You will find following scree image.

Press “Building maps” button to build a new map

Press “Set coordinates” button to assign coordinate for Home Station and tables site



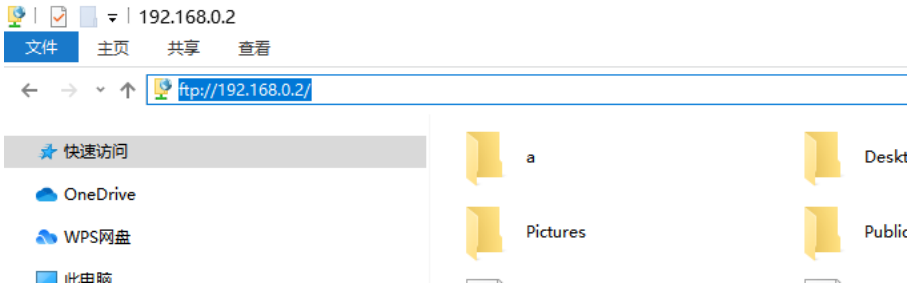
2.4.1 After you press “Building maps”， please use robot remote joystick to drive robot slowly running along the corridors which robot will walking in future，the room maps will be displayed on the screen. This job will take about 20~30 minutes for a general middle size restaurant. When the new map down， please press ”Exit” button see following screen.



2.4.2 Edit map：

1st, Install an image edit software (make sure it can edit .pgm format photo) on you Notebook PC, such as GIMP , Photoshop, ACDsee.
Then open your PC Wi-Fi search and connect to robot hotspot “RobotHost”.
Password for “RobotHost” : szyz123456

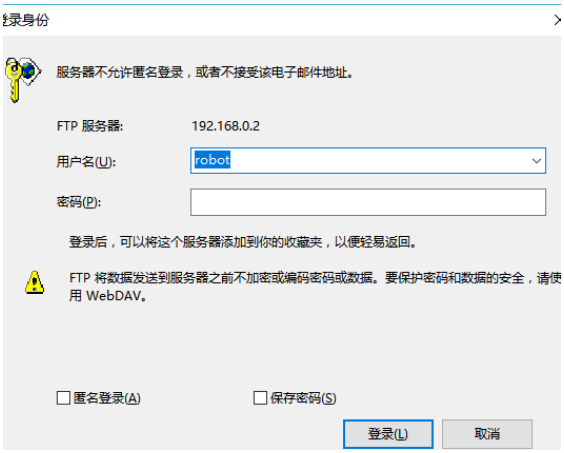
2nd , Open your PC web viewer, input ftp://10.42.0.1:21 at address row.



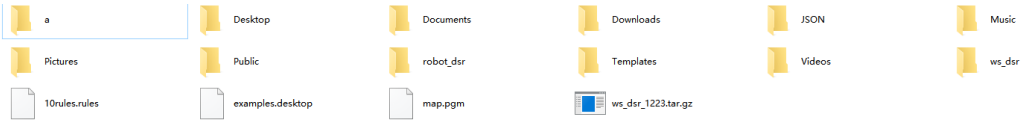
3rd :Input ftp username and password。

USERNAME：robot

PASSWORD: 1



After ftp login successfully, you will find following folds and files:



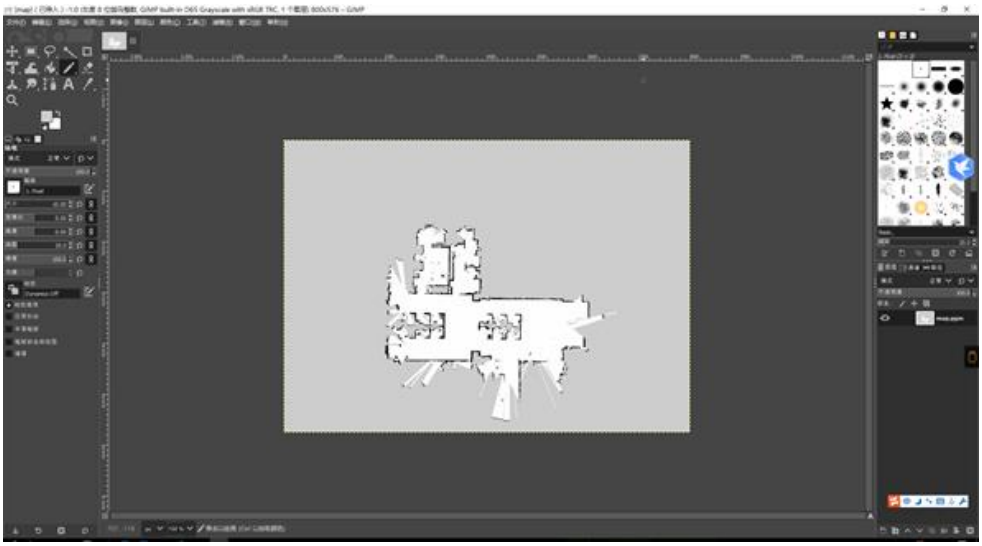
Please copy the robot_dsr/map1.pgm file to your PC local, then edit this photo according to following rules:robot_dsr/map.pgm

Here we use GIMP to edit this demo map:

1) Set map size: Click Image - canvas size - input the appropriate width and height to cut out the map. If your map is inclined, you can use image rotate tool to rotate map to good view degree.

   Note: gray color on the image means invalid area, it can be cut off.

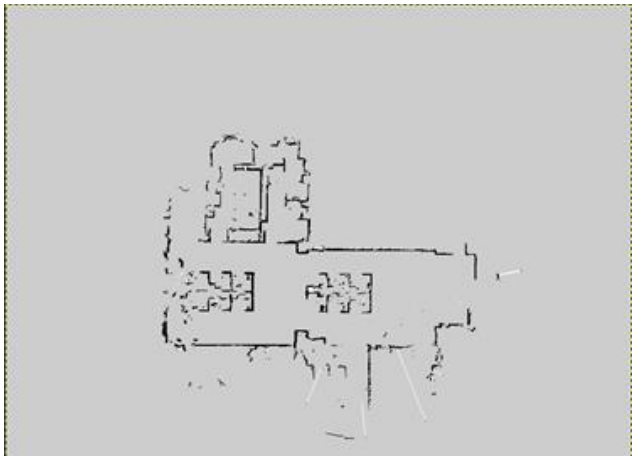
   As shown following:



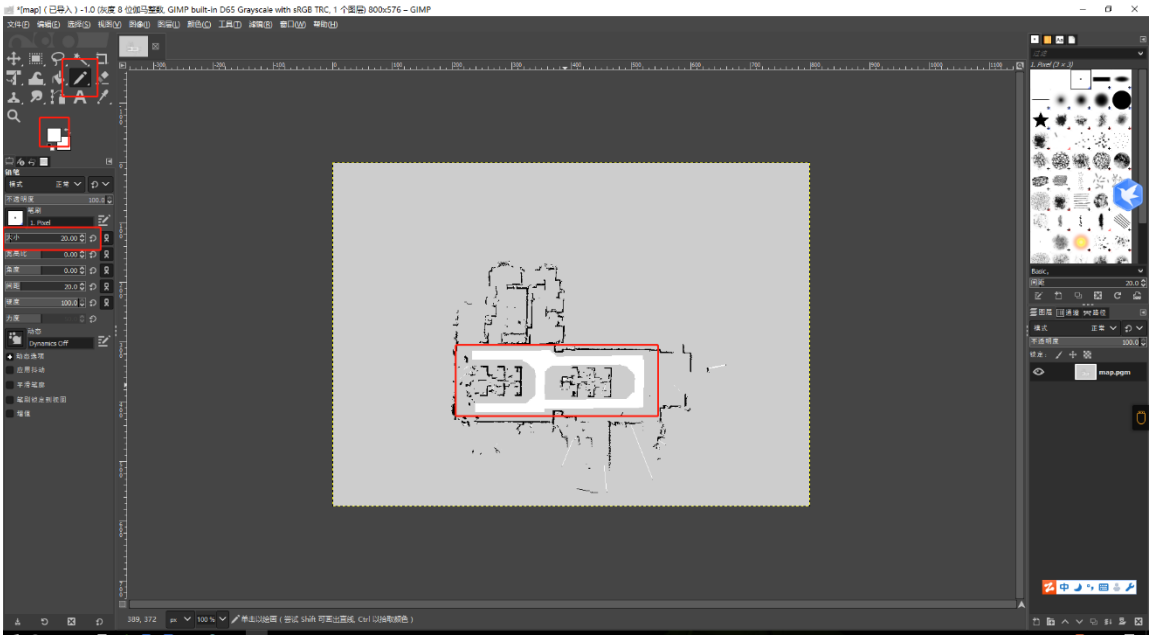
Click change size to confirm

2) Fill in white area:

Click "oil barrel filling tool", select the color (press and hold down the CTRL and click the gray area) to gray, then click the oil barrel on the white area. The effect is as shown in following:



3) Select the pencil tool, select white color, brush size as appropriate. Draw out the white line path, and the robot will only walk in the white area. It is recommended to use the shift shortcut key to draw lines when painting lines, so that the effect is relatively smooth. As shown in following



4)Save map:

Click file export as -- click export (pay attention to the export path)

After editing, please put the new map into the robot_Under DSR, the original name is "map. pgm".

Note: White color paths/area means robot can walk here valid. no traffic area

Gray color area means robot is forbid to walk, these are invalid area for robot.

5) Power off robot

After doing above items, please power off robot main power， and move robot to the “Home Station”, This “Home Station” generally is the robot charger dock station or the food counter center.

2.4.3 Setting the Home Station coordinate and all tables coordinates：

1) Set the catering location:

After the completion of map building and map editing, the 1st thing is to set the coordinate values for “Home Station”. It is necessary to manually re-write the coordinate values in robot_dsr/install/share/rbx1_nav/launch/tb_amcl_bd.launch file, these three re-write data are: initial_pose_x , initial_pose_y, and initial_pose_a. (Note: you should use ftp to login the robot PC firstly, this file is stored in robot PC.)

How to calculate the real world coordinate data for a map pixel:

The lower left corner of the map coordinate is the origin (0,0) zero site.

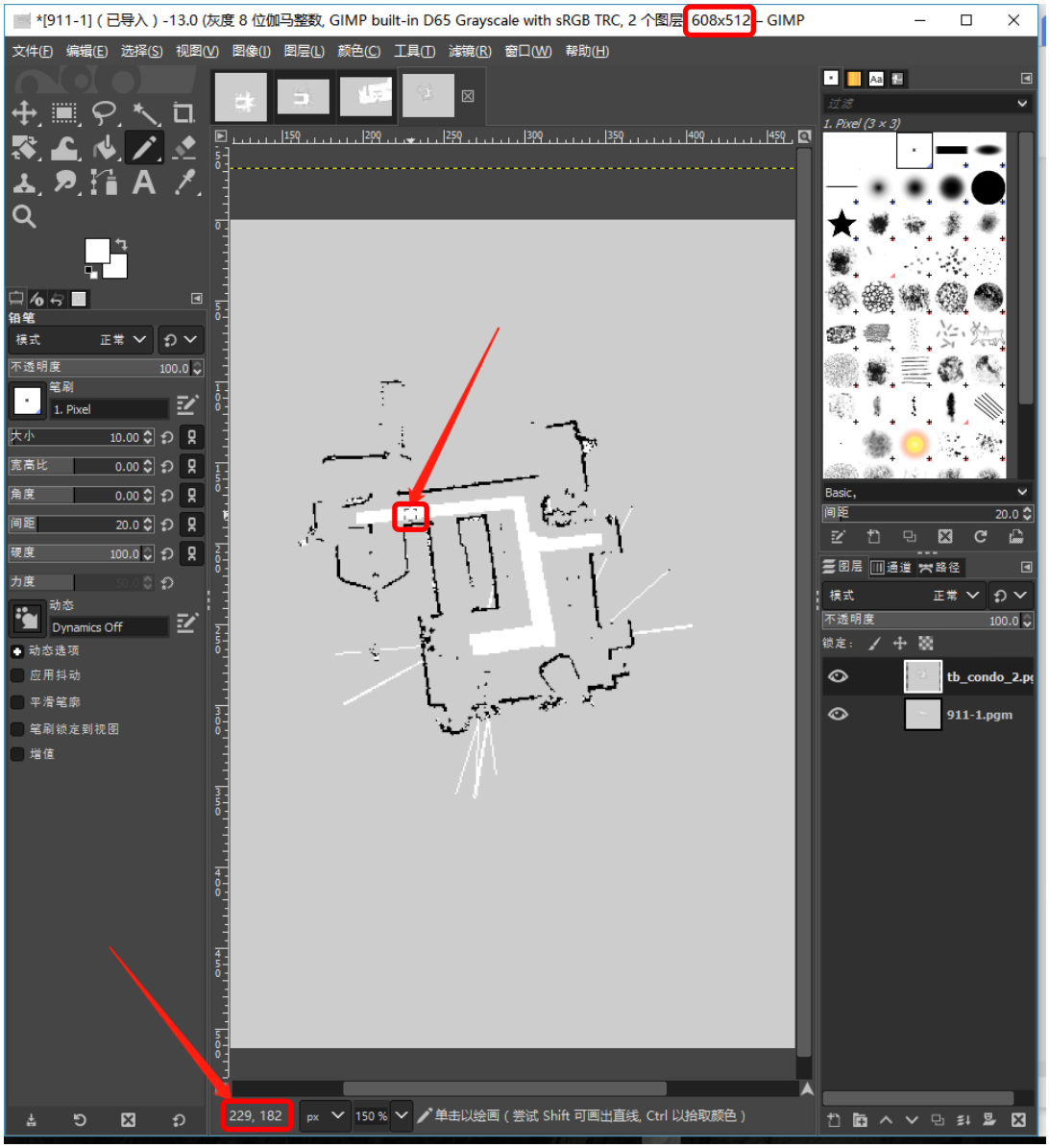
The ratio of pixel to map coordinate is 0.05

Use GIMP open the map and move mouse to the site of the Home Station you wanted, as shown in following. The map pixel coordinate for this site is [229 ,182], which is shown on the bottom row, see following demo:

In following image, top red mark "608x512" shows the map size(W x H)

middle red mark shows the site of "Home Station"

lower red mark shows pixel coordinate for Home Station



The real world coordinates for pixel [229, 182] can be calculated as

x = 229 * 0.05 = 11.45 (meters)

y = (512 - 182) * 0.05 = 16.5 (meters)

a = 0.0 , head to the right side of the map, or

1.57, head to the top side of the map, or

3.14, head to the left side of the map, or

-1.57, head to the down side of the map

Re-write initial_pose _x, initial_pose_y, and initial_pose_a with this new [11.45, 16.5, 1.57], see following:

```
<?xml version="1.0"?>
<launch>
  <arg name="use_map_topic" default="false"/>
  <arg name="scan_topic" default="scan"/>
  <node name="map_server" pkg="map_server" type="map_server"
args="/home/robot/robot_dsr/map.yaml"/>
  <!--node pkg="amcl" type="amcl" name="amcl" clear_params="true"
output="screen"-->
  <node pkg="amcl_wyj2" type="amcl_wyj2" name="amcl_wyj2"
clear_params="true" output="screen">
    <param name="use_map_topic" value="$(arg use_map_topic)"/>
    <!-- Publish scans from best pose at a max of 10 Hz -->

    <param name="initial_pose_x" value="0"/>
    <param name="initial_pose_y" value="0"/>
    <param name="initial_pose_a" value="0"/>

    <param name="odom_model_type" value="diff"/>
    <param name="odom_alpha5" value="0.1"/>
    <param name="gui_publish_rate" value="10.0"/>
    <param name="laser_max_beams" value="60"/>
    <param name="laser_max_range" value="8.0"/>
    <param name="min_particles" value="500"/>
    <param name="max_particles" value="1000"/>
    <param name="kld_err" value="0.01"/>
    <param name="kld_z" value="0.99"/>
    <param name="odom_alpha1" value="0.2"/>
    <param name="odom_alpha2" value="0.2"/>
    <!-- translation std dev, m -->
    <param name="odom_alpha3" value="0.2"/>
    <param name="odom_alpha4" value="0.2"/>
    <param name="laser_z_hit" value="0.95"/>
    <param name="laser_z_short" value="0.1"/>
```

After re-write robot_dsr/install/share/rbx1_nav/launch/tb_amcl_Bd.launch file, move robot to this home station and restart the robot. When robot restart successfully, cat face will be normal “sleeping”, no “Locating Failure”on screen. In the future, if you want to change this Home Station, just drive the robot to the new site, and then enter the setting map interface, click the “Confirm the charging position” button, see following:

Note: “Confirm charging position” = set a new “Home station”

See above image, similarly, you can set all table site coordinates, just drive the robot to the front of the dining table with the remote controller, and click “Add dining table” button.

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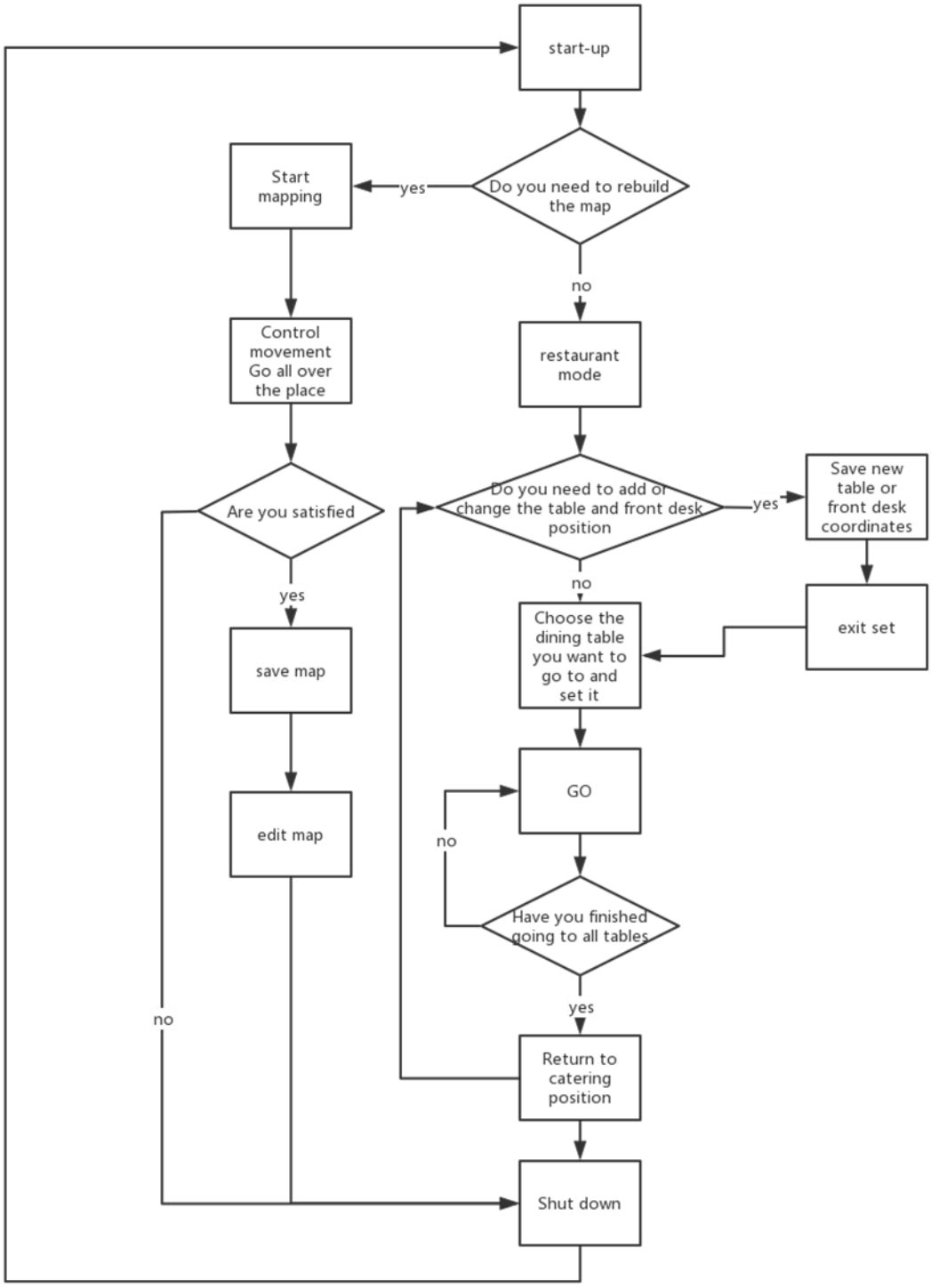
Diagram for robot operating process



§3 CAUTION

3.1 Pre charging: before the robot is used for the first time, please put it on the charging dock to charge for at least 3 hours, or you can use portable charger to charge the robot at least 3 hours.

3.2 Operators: operators must receive technical training from YZ Robot tech Co., Ltd. After passing the training, the robot can be operated directly.

3.3 walking range: the walking range of dsr02 robot can not exceed the delimited range of the initial construction map, and the maximum activity space range of dsr02 standard configuration is less than 2000 square meters. If the use site is more than 2000 square meters or the robot needs to be moved to other places outside the initial map for use, the technical personnel of our company should consult in advance.

3.4 Troubleshooting: if the robot is abnormal in use, please immediately press the red emergency stop switch, and long press to turn off the power, then slowly push the robot to the charging pile and restart. Generally, the robot will return to normal. If the robot still can't use normally after restart, please inform our technical service personnel for remote intervention or restart as soon as possible Door to door processing. Do not disassemble and repair without permission.

3.5 schedule maintenance: the dsr02 robot needs to be stopped for maintenance every 200 km or 2000 hours. The maintenance of the robot is carried out by technicians authorized by YZ Robot Co Ltd to the actual working site of the robot. Unauthorized personnel are forbidden to disassemble.

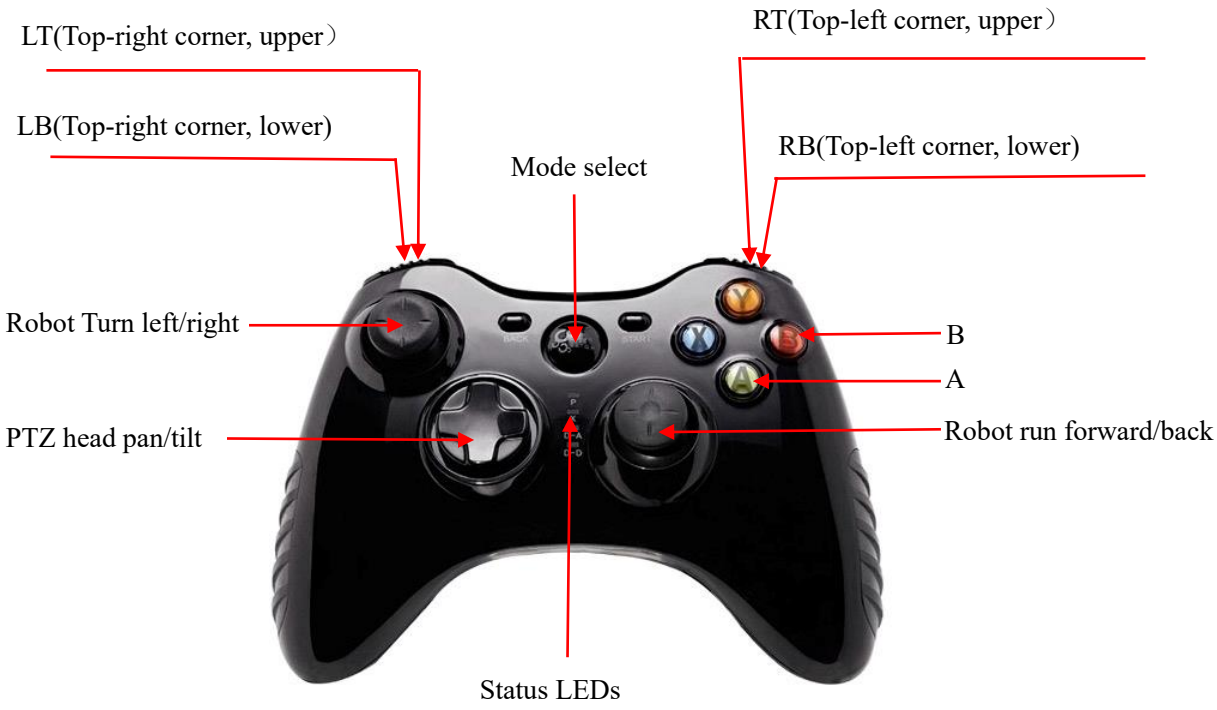
3.6 safety precautions: please remember the following important safety precautions:

When the robot walks abnormally, please press the red emergency stop switch on the back of the machine immediately!
In case of smoke or peculiar smell in the robot body, please turn off the machine power immediately!
In case of serious collision or fall accident, please turn off the power immediately!

Appendix A: introduction of remote joystick and map creating

1、 Understanding joystick

When creating the site map and manual remote control robot for the first time, we must rely on the remote control handle. The following figure shows the front view of the remote control handle, and the distribution of the keys is as follows:



Note: X, Y, BACK, START, these four keys are not actived。

2. How to use

Firstly, make sure MR9 robot is power on. Then press the circular "mode select” key at the middle position above the handle. If you press it once, the remote control function of the handle will be turned on normally. At this time, the first and the third status LED will appear green constants. (Note: if all four LEDs flash at the same time, it means that the robot is faulty or the handle is too far away from the robot, so the handle can't receive the robot signal; if two indicator lights flash, it means the battery power in the handle is too low, please charge the handle with standard USB cable for 1 hour; if the 2nd and 4th LED are on, it means that the mode and robot do not match Press "mode selection key" again.)

2.1 Control robot move

Robot turn left/right：Hold on“LB”and push“Robot turn”left/right

Robot run forward/back：Hold on“LB”and push“Robot run”forward/back

2.4 Remote control robot goes to the charging dock to charge

When the robot is about 1 m in front of the charging dock, if the <LB> + <A> key is pressed and hold at the same time, the robot will automatically return to the charging point to charge.

When the robot is not about 1 meter in front of the charging pile, please use the remote control handle to move the robot firstly about 1 meter in front of the charging pile, and then press "LB key" + "a key" at the same time.

When the map has been built and the robot is positioning and navigating according to the map, if press the "LB key" + "RB key" + "a" key at the same time, and the robot will be terminated all current tasks, go back and recharge by yourself.

Appendix A DSR02B Delivery Service Robot specification:

Basic Functions	LIDAR SLAM/ Room Delivery Service/ Vision Surveillance/ Auto-Charging
Recommended application	Restaurant, Hotel & Hospital delivery goods serveice.
Size and weight	52X48X125cm, 35Kg
Storage cabin volume	Three layers 40x40x30cm
Max. load weight	3x10Kg.
Localization & Navigation	LIDARs is used as main SLAM, Computer-vision supported.
Motors & driving	Two wheel differential drive, Integrated 2X150 hub-wheel motor, high efficiency and low noise.
Main hardware	The main board is industrial PC, CPU is core I5 processor, 4G RAM, auxiliary board is ARM arch.
Robot software system	Main O/S is LINUX, with ROS to communicate and cooperate with each function modules.
Client Software	Provide client monitoring software; provide Android SDK for customer development.
Robot motion features	Walking speed is 0.2 to 0.8 m/sec, maximum climbing angle is 10 degrees, and turning radius is 0.25m.
Obstacle Avoidance	Laser radar scanning, ultrasonic detection and mechanical anti-collision switch three safe.
Battery Specification	The built-in battery is 18V20AH LIFEPO4.
Automatic Charging	After the task is completed, will automatically back to charging station to supply energy.
Maximum walking distance	For a fully charged robot, it can walk continuously up to 3000M.

Appendix C DSR02B Drawing