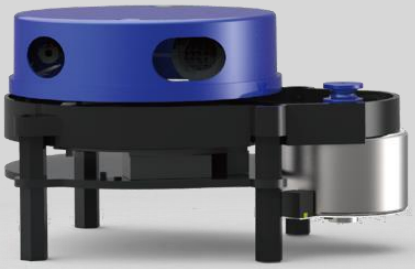
YDLIDAR X4

USER MANUAL



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YDLIDAR X4 DEVELOPMENT KIT

The YDLIDAR X4 (hereafter abbreviated as X4) development kit is designed to facilitate users' performance evaluation and early development of the X4. By using the X4 development kit and matching evaluation software, point cloud data scanned by X4 to the environment can be observed on the PC or developed on the SDK.

Development Kit

The X4 development kit has the following components:

YDLIDAR X4 | USB Cable | USB Adapter board | PH2.0-8P Cable

FIG 1 YDLIDAR X4 DEVELOPMENT KIT

CHART 1 YDLIDAR X4 DEVELOPMENT KIT DESCRIPTION

Item	Qty	Description
X4 Lidar	1	Standard version of the X4 Lidar. The X4 has an integrated motor drive for motor control.
USB cable	1	Use with USB adapter board to connect X4 and PC. It is both a power supply line and a data line.
USB adapter board	1	This component is used for USB to UART functions, enabling X4 and PC to be quickly interconnected. Also supports the serial port DTR signal to the X4 motor stop control. A MicroUSB Power Interface (PWR) for auxiliary power supply is also provided.
PH2.0-8P cable	1	This component meets the user's development needs in a multi-platform environment.

Note: USB adapter board has two MicroUSB interfaces: USB_DATA, USB_PWR.

USB_DATA: Data supply multiplex interface. In most cases, just using this interface can meet the power and communication needs.

USB_PWR: Auxiliary power interface. The USB interface of some development platforms has a weak current drive capability, and auxiliary power can be used.

WINDOWS USAGE GUIDE

Device connection

When evaluating and developing X4 under windows, you need to interconnect X4 and PC. The specific process is as follows:

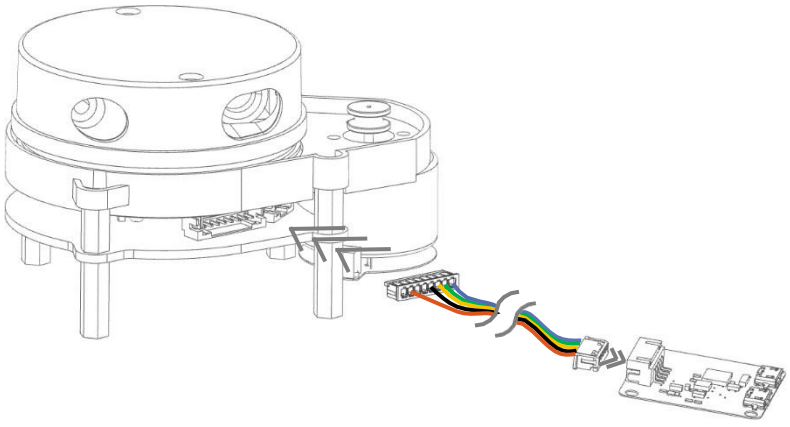

FIG 2 YDLIDAR X4 CONNECTION STEP 1

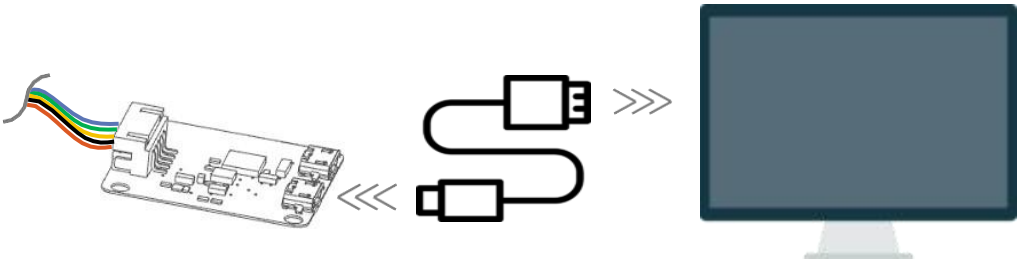

FIG 3 YDLIDAR X4 CONNECTION STEP 2

Connect the adapter board and X4 first, and then connect the USB cable to the USB port on the adapter board and the PC. Note that the USB interface's Micro interface is connected to the USB adapter's USB_DATA. After the X4 is powered on, it is in idle mode and the motor does not turn.

The drive current of the USB interface of some development platforms or PCs is weak, and the X4 needs to access the +5V auxiliary power supply, otherwise the radar will work abnormally.

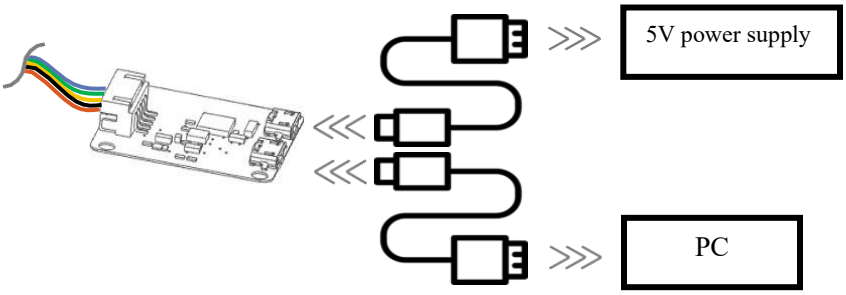

FIG 4 YDLIDAR X4 AUXILIARY POWER SUPPLY

Driver Installation

To evaluate and develop the X4 under Windows, you need to install the serial port driver of the USB adapter board. The USB adapter board of this kit adopts CP2102 chip to realize serial port (UART) to USB signal conversion. Its driver can be downloaded from our official website or downloaded from the official website of Silicon Labs:

http://ydlidar.com/

http://cn.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers

After extracting the driver package, run the CP2102's Windows driver installation file (exe file under CP210x_VCP_Windows). Please select the 32-bit version (x86) or 64-bit version (x64) installation program according to the version of the windows operating system.

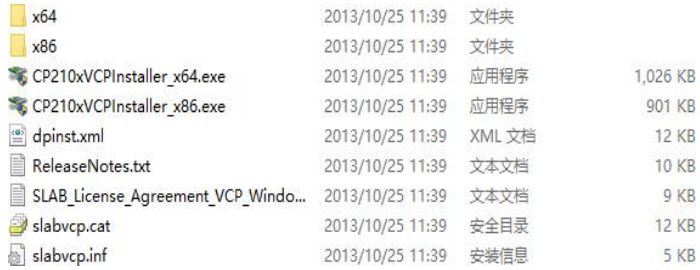

FIG 5 YDLIDAR X4 DRIVER VERSION SELECTION

Double-click the exe file and follow the prompts to install it

FIG 6 YDLIDAR X4 DRIVER INSTALLATION I

After the installation is complete, you can right-click My Computer and select Properties. Under the System screen, select Device Manager from the left menu to access the device manager. Expand [Port] to see the serial port name corresponding to the identified USB adapter, that is, the driver

installation is successful. The following figure shows COM3. (Note that the port must be checked in case of X4 and PC interconnection)

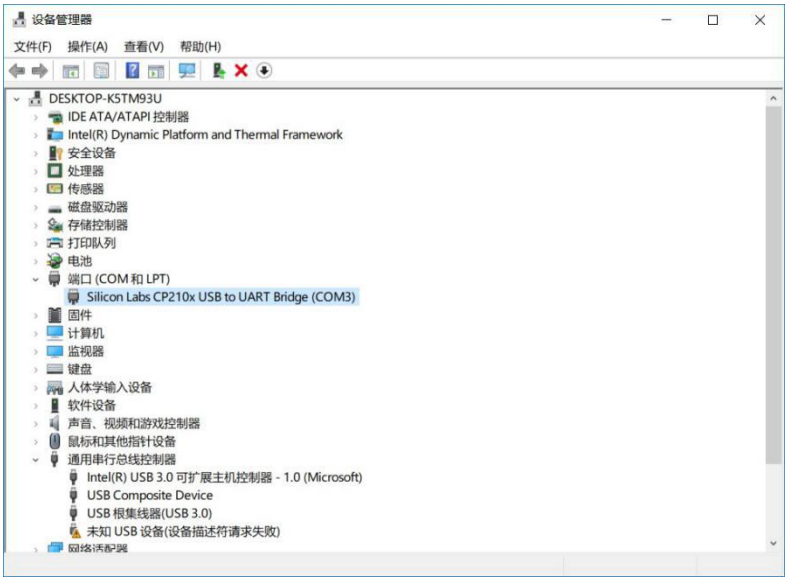

FIG 7 YDLIDAR X4 DRIVE INSTALLATION II

Evaluation software

YDLIDAR provides Point Cloud Viewer, a point cloud data visualization software for X4 real-time scanning. The user can intuitively observe the X4 scan effect picture using this software. YDLIDAR provides X4 real-time point cloud data and real-time scanning frequency, and X4 version information can be read at the same time. And can save the scan data offline to an external file for further analysis.

Before using YDLIDAR, make sure that the X4 USB adapter board serial port driver is installed successfully, and check whether the X4 and PC USB ports are successfully interconnected. Run the evaluation software: PointCloudViewer.exe, select the corresponding serial port number and model number.

FIG 8 YDLIDAR X4 EVALUATION SOFTWARE

Note: The Lidar does not turn on the heartbeat function by default. This function needs to send the scan command continuously to make it work normally. If the scanning frequency is stopped, the Lidar will stop scanning. Currently, G4 and F4 are compatible with this function, and X4 and X4 are not compatible.

After confirmation,you can see the following screen：

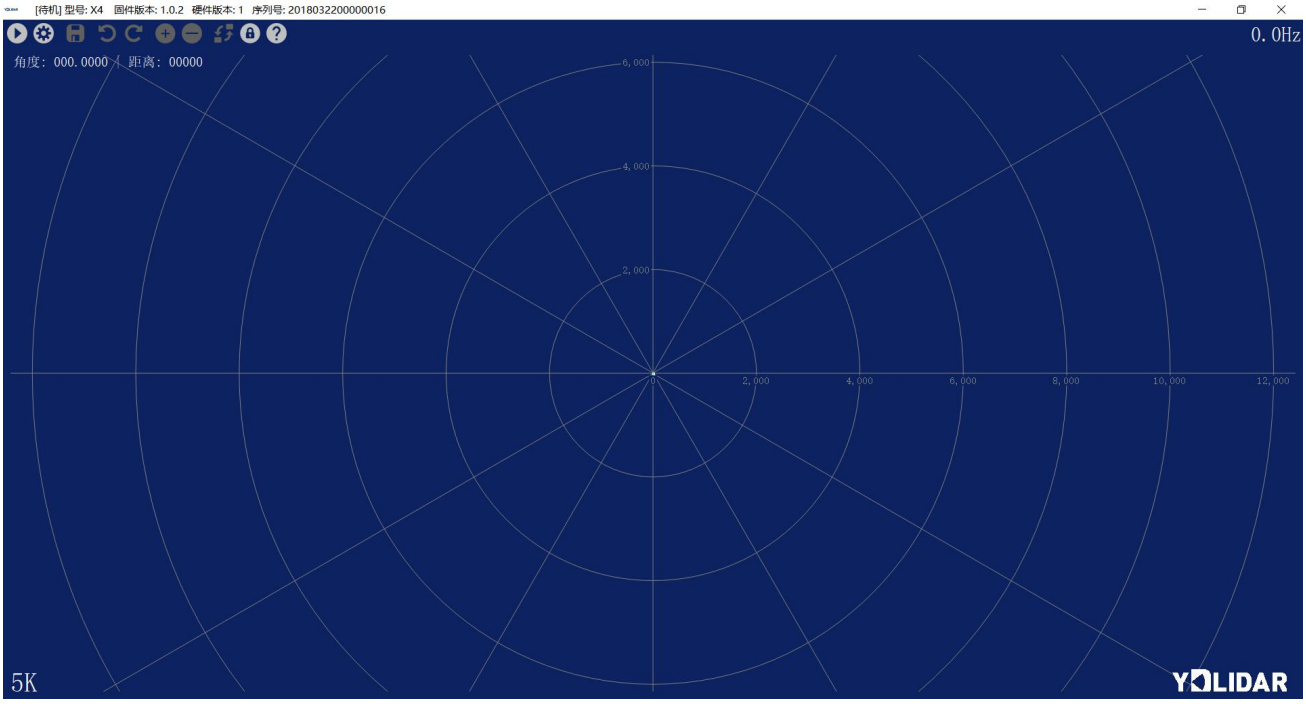

FIG 9 POINTCLOUD VIEWER EVALUATION SOFTWARE STARTUP DISPLAY

START SCANNING

Click  to start scanning and display the environment point cloud.

Clicking  to stop it,as shown below:

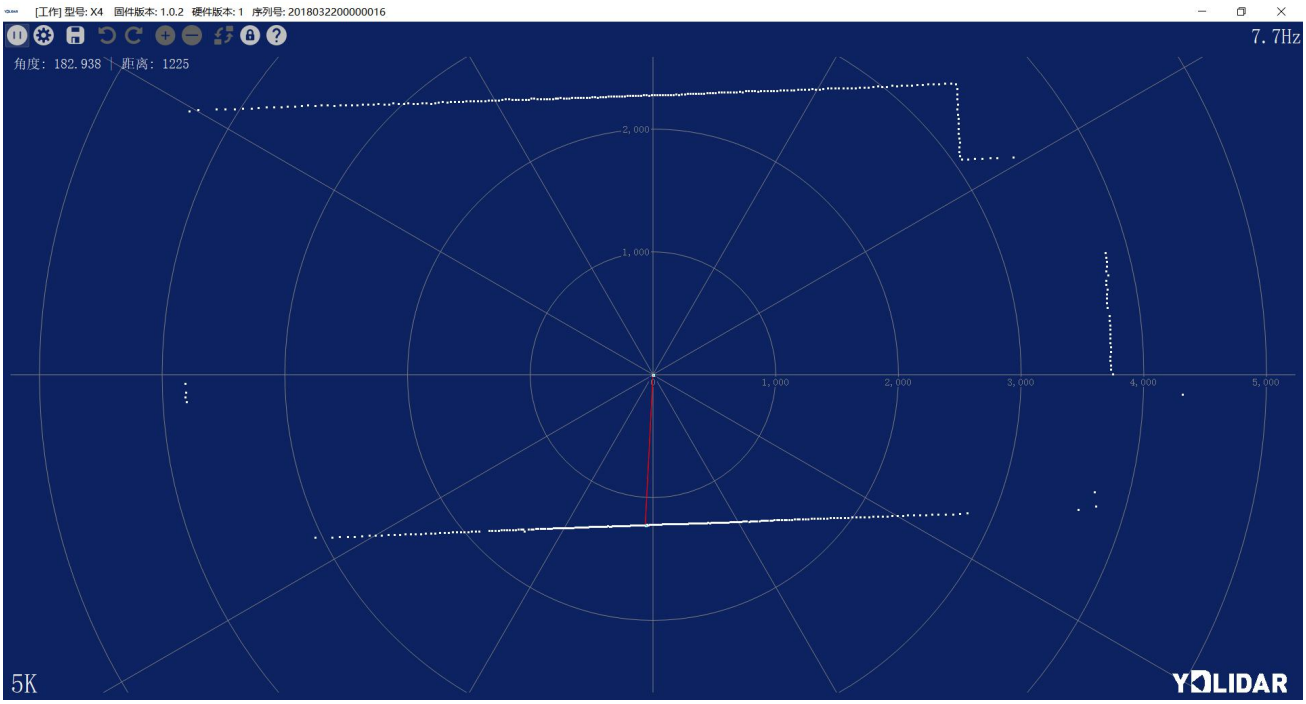

FIGURE10 LIDAR SCANNING POINT CLOUD DISPLAY

SYSTEM SETTINGS

Click System Settings  and the following settings box will pop up:

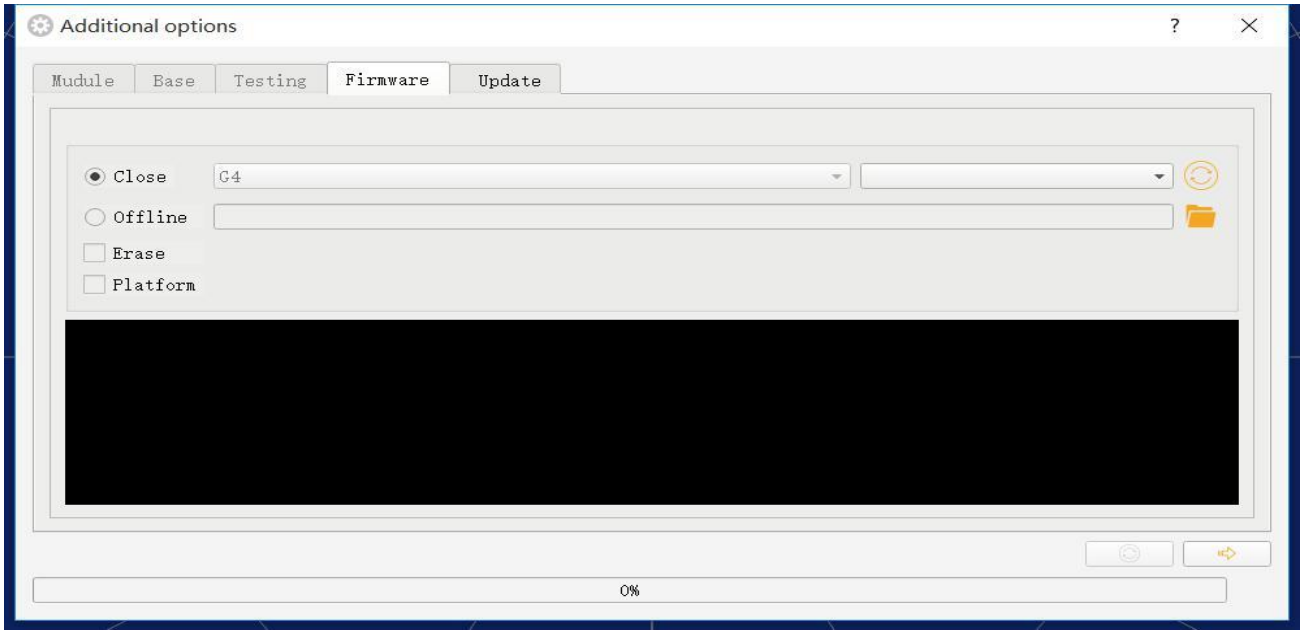

FIGURE 11 CLIENT SETTINGS BOX

As shown in the figure, you can configure and detect the Lidar on this setup page, as well as Lidar firmware upgrade, client software upgrade, etc.

SAVE DATA

During Lidar scanning,click  ， Save the point cloud data as prompted.The system will save the point cloud information scanned in a circle according to the following format.

```
angle:9.5469    ,    distance:4654
angle:9.8125    ,    distance:4709
angle:10.094    ,    distance:4763
angle:10.625    ,    distance:4947
angle:11.125    ,    distance:6204
angle:11.203    ,    distance:0
angle:11.391    ,    distance:6253
angle:11.766    ,    distance:0
angle:12.609    ,    distance:0
angle:12.719    ,    distance:7895
```

FIGURE 12 POINT CLOUD DATA SAVE FORMAT

Ranging frequency

 is used to switch the Lidar's ranging frequency. The X4 supports 4K, 8K, and 9K ranging frequency switching. Other versions of the Lidar do not support this function, and the click is invalid. When the Lidar is in the scanning state, you need to click the scanning control again after switching the ranging frequency.

ANGLE CALIBRATION

During the mechanical assembly of the Lidar, the user may have a deviation in the zero angle. In this case, the angle calibration function of the client can be used to calibrate according to actual needs. The specific operations are as follows:

(1) Unlock calibration function

Click the unlock control  , the system will pop up the login box, the default password is ydlidar. The effect of these controls  will change after unlocking.

(2) setting the baseline

Click  and the system will provide a baseline of the appropriate size as a reference for the adjustment.

(3) Adjusting the angle

Click  to adjust the angle to the appropriate position.

(4) save configuration

After the adjustment is completed, click the system will automatically save the calibration parameters, and the calibration will take effect after saving.

(5) Lock calibration function

After the calibration is saved, click again to lock the function to prevent misoperation. these controls will return to normal functionality after being locked.

FIRMWARE UPGRADE

Click System Settings and select Firmware, as shown in Figure 11. Click to get the latest firmware. When there is a new version, the user can click on the control to perform a firmware update on the Lidar.

Note:During the upgrade process,keep the Lidar power supply normal,communication stable,network steady.Do not plug or unplug the Lidar serial port.

SOFTWARE UPGRADE

The client software will be version-changed and users can update to the latest version for a better experience.

Click System Settings and select Update, as shown below:

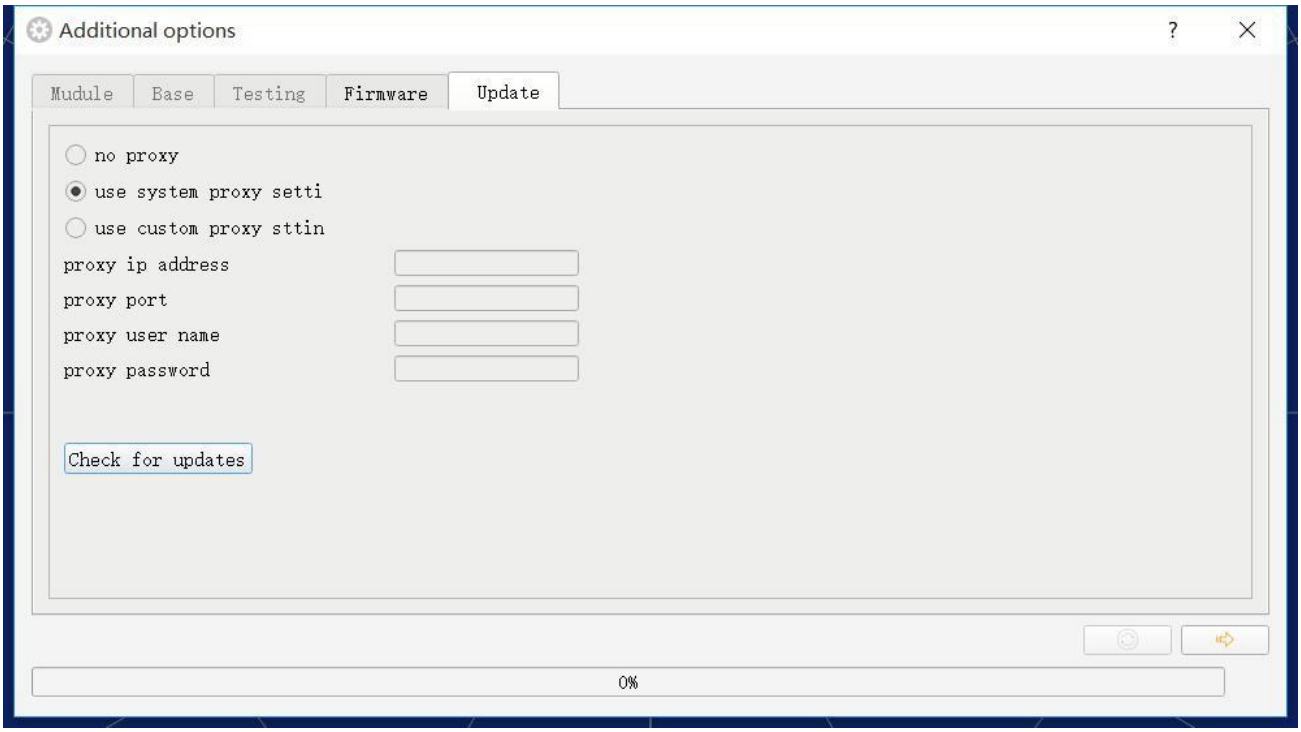

FIGURE 13 SYSTEM UPDATE PAGE

Select the configuration as shown above, click ‘check for updates’, if there is no new version, the system will prompt no update; when there is a new version, the software version information will be filled in the information box, click ➪ to update the client software.

LINUX ROS OPERATION

Because there are many Linux versions, this article only uses Ubuntu 16.04, Kinetic version ROS as an example.

Document description

Download the latest ROS driver package for YDLIDAR X4 on GitHub https://github.com/YDLIDAR/ydlidar/tree/X4;

Device connection

Under Linux, the X4 and PC interconnect processes are consistent with those under Windows. See Device Connection under Window.

ROS Driver Installation

Before doing the following, make sure that the Kinetic version ROS environment is installed correctly.

（1） Use the command to create the ydlidar_ws workspace and copy the ROS driver package ydlidar in the X4 package to the ydlidar_ws/src directory. Switch to the ydlidar_ws workspace and compile again.

```
$ mkdir -p ~/ydlidar_ws/src
$ cd ~/ydlidar_ws
$ catkin_make
```

（2） After the compilation is complete, add the ydlidar environment variable to the ~/.bashrc file and make it effective.

```
$ echo "source ~/ydlidar_ws/devel/setup.bash" >> ~/.bashrc
$ source ~/.bashrc
```

（3） Add a device alias /dev/ydlidar to the X4 serial port.

```
$ cd ~/ydlidar_ws/src/ydlidar/startup
$ sudo chmod +x initenv.sh
$ sudo sh initenv.sh
```

RVIZ installation

（1） Online installation

```
$ sudo apt-get install python-serial ros-kinetic-serial g++ vim \
 ros-kinetic-turtlebot-rviz-launchers
```

（2） If there is a problem with the installation, update the source cache and reinstall it.

```
$ sudo apt-get update
```

RVIZ Check the scan results

Run the launch file and open rviz to view the X4 scan results, as shown in the following figure:

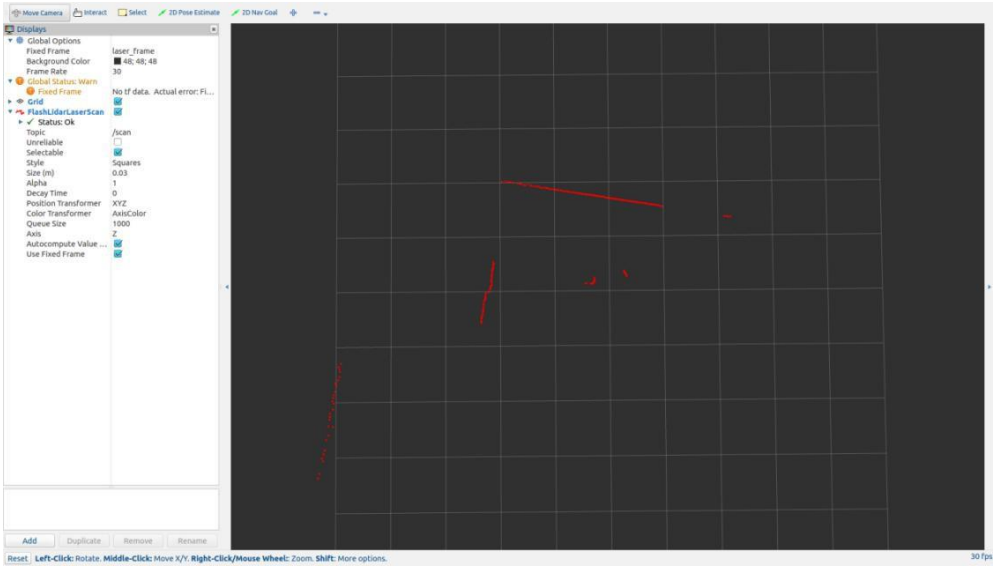

FIG14 YDLIDAR X4 RVIZ

Modify the scan angle problem

The scanning data seen by running the launch file is displayed by default with 360- degree data. To modify the display range, you need to modify the configuration parameters in the launch file. The specific operation is as follows:

（1） Go to X4.launch's directory and use vim to edit X4.launch. The contents are as shown in the figure:

```
$ roscd ydlidar/launch

$ vim  lidar.launch
```

```
<launch>
  <node name="ydlidar_node"  pkg="ydlidar"  type="ydlidar_node" output="screen">
    <param name="port"         type="string" value="/dev/ydlidar"/>
    <param name="baudrate"     type="int"    value="115200"/>
    <param name="frame_id"     type="string" value="laser_frame"/>
    <param name="angle_fixed"  type="bool"   value="true"/>
    <param name="intensities"  type="bool"   value="false"/>
    <param name="angle_min"    type="double" value="-180" />
    <param name="angle_max"    type="double" value="180" />
    <param name="range_min"    type="double" value="0.08" />
    <param name="range_max"    type="double" value="8.0" />
    <param name="ignore_array" type="string" value="" />
  </node>
  <node pkg="tf" type="static_transform_publisher" name="base_link_to_laser4"
    args="0.2245 0.0 0.2 0.12 0.0  0.0 /base_footprint /laser_frame 40" />
</launch>
```

FIG 15 LIDAR.LAUNCH FILE

（2） The X4 lidar coordinates follow the right-hand rule within ROS, with an angle range of [-180, 180]. "angle_min" is the start angle, and "angle_max" is the end angle.
The specific scope needs to be modified according to actual use.

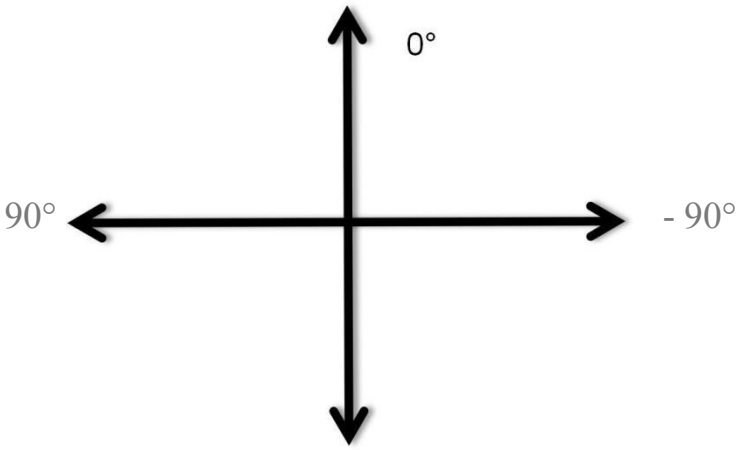

FIG16 YDLIDAR X4 COORDINATES DEFINITION

USE CAUTION

Temperature

When the working environment temperature of X4 is too high or too low, it will affect the accuracy of the distance measuring system. It may also damage the structure of the scanning system and reduce the life of the X4 lidar. Avoid use in high temperature (>40 degrees Celsius) and low temperature (<0 degrees Celsius) conditions.

Ambient lighting

The ideal working environment for the X4 is indoor, indoor lighting (including no light) will not affect the X4 work. However, avoid using a strong light source (such as a high-power laser) to directly illuminate the X4's vision system.

If you need to use it outdoors, please avoid that the X4's vision system is directly facing the sun. This may cause permanent damage to the vision system's sensor chip, thus invalidating the distance measurement.

Please note that the X4 standard version is subject to interference in outdoor strong sunlight reflection environments.

Power demand

During the development process, since the drive current of the USB interface of each platform or the USB interface of the computer may be too low to drive the X4, the external power supply of the +4V to the X4 needs to be provided through the USB_PWR interface of the USB interface board. It is not recommended to use mobile phone power bank because the voltage ripple of some brands of power bank is too large.