YDLIDAR

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YDLIDAR X4PRO
USER MANUAL



www.ydlidar.com

Shenzhen EAI Technology Co.,Ltd.

CONTENTS

1 YDLIDAR X4PRO LIDAR DEVELOPMENT KIT 1
1.1 Development Kit 1
2 USAGE UNDER WINDOWS 1
2.1 Device Connection 1
2.2 Driver Installation 3
2.3 Evaluation Software Usage 4
2.3.1 Start Scanning 5
2.3.2 Data Storage 6
2.3.3 Display Mean and Standard Deviation 6
2.3.4 Play and Record 6
2.3.5 Debug 7
2.3.6 Filter 8
3 LINUX ROS OPERATION 8
3.1 Device Connection 8
3.2 Compile and Install YDlidar-SDK 8
3.3 ROS Driver Installation 9
3.4 Run the ydlidar_ros_driver 10
3.5 RVIZ View Scan Results 10
3.6 Modify Scan Angle 10
4 CAUTION 12
4.1 Ambient Temperature 12
4.2 Ambient Lighting 12
4.3 Power Supply 12
5 REVISE 13

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1 YDLIDAR X4PRO LIDAR DEVELOPMENT KIT

The development kit of YDLIDAR X4PRO lidar (hereinafter referred to as X4PRO) is an accessory tool provided for performance evaluation and early rapid development of the X4PRO. Through the X4PRO development kit, and with the evaluation software, users can observe point cloud data scanned by X4PRO on your environment or development on the SDK.

1.1 Development Kit

The X4PRO development kit has the following components：



X4PRO Lidar　　USB Type-C Cable　　USB Adapter Board

FIG 1 YDLIDAR X4PRO DEVELOPMENT KIT

CHART 1 YDLIDAR X4PRO LIDAR DEVELOPMENT KIT DESCRIPTION

Item	Qty.	Description
X4PRO Lidar	1	Standard version of the X4PRO Lidar. The X4PRO has an integrated motor drive for despin control and motor control.
USB Type-C Cable	1	Use with USB adapter board to connect X4PRO and PC. USB cable is both a power supply cable and a data cable.
USB Adapter Board	1	Realize the function of USB to UART, which is convenient for the fast interconnection between X4PRO and PC. Serial port DTR signal to control X4PRO motor despin control. In addition, a Micro USB power interface (PWR) for auxiliary power supply is provided.

Note: USB Adapter board has two USB TYPE C interface：USB_DATA、USB_PWR.

USB_DATA: Data powered interface. In most cases, this interface can be used to meet power and communication requirements.

USB_PWR: Auxiliary power supply interface. The USB interface of some development platforms has weak current drive capability. At this time, auxiliary power supply can be used.

2 USAGE UNDER WINDOWS

2.1 Device Connection

When evaluating and developing X4PRO under windows, X4PRO and PC needed to connected. The specific process is as follows:

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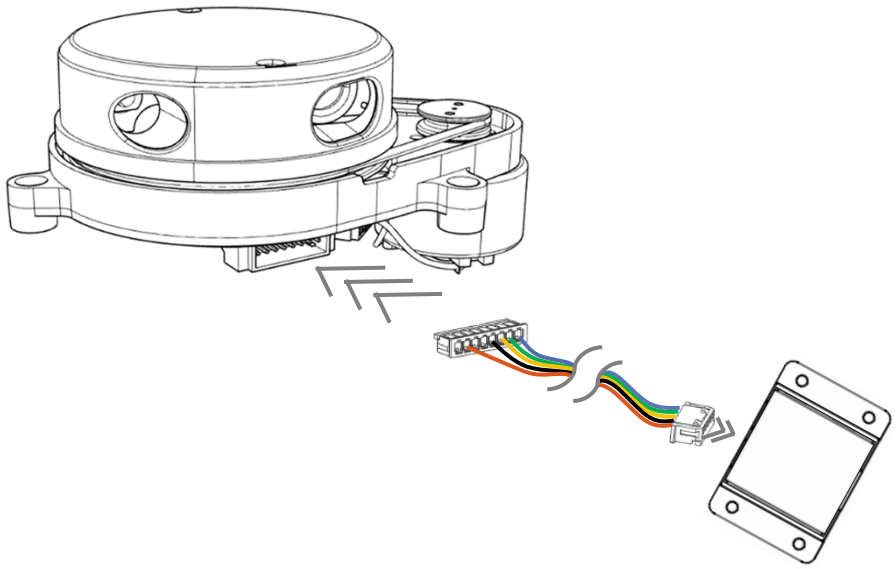


FIG 2 YDLIDAR X4PRO DEVICE CONNECTION STEP 1

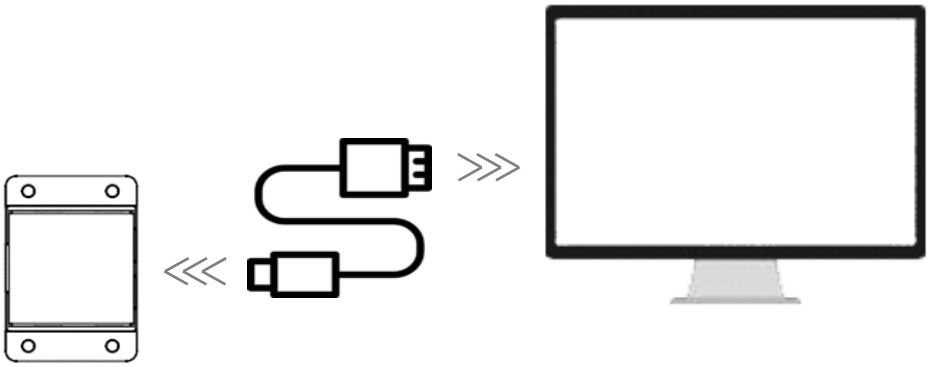


FIG 3 YDLIDAR X4PRO DEVICE CONNECTION STEP 2

Connect the adapter board with X4PRO first, then connect the USB cable to the USB port of the adapter board and the PC. Note that the Type-C interface of the USB cable is connected to the USB_DATA of the USB adapter board.

The drive current of USB interface of some development platforms or PC is not sufficient. X4PRO need to be connected to the auxiliary power supply of +5V, otherwise the lidar will be abnormal.

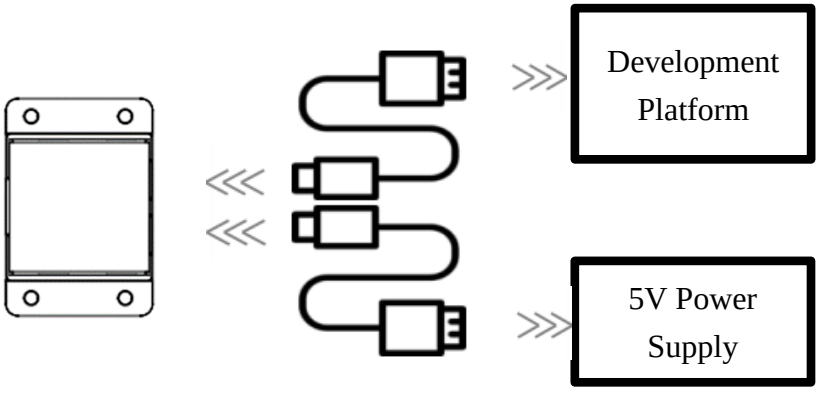


FIG 4 YDLIDAR X4PRO AUXILIARY POWER SUPPLY

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2.2 Driver Installation

To evaluate and develop the X4PRO under Windows, the serial port driver of the USB adapter board needed to be installed. 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.

https://www.ydlidar.com/dowfile.html?id=97

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

After decompressing 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.

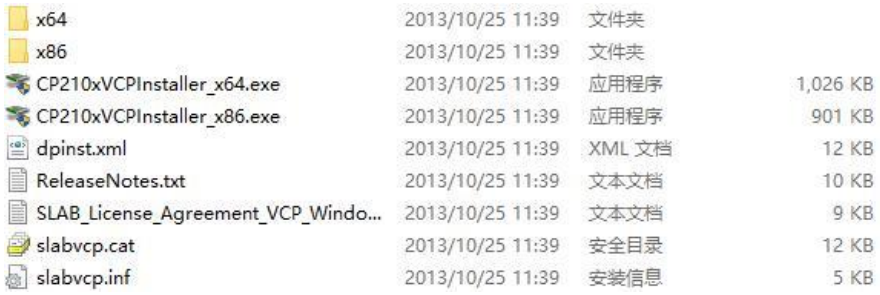


FIG 5 YDLIDAR X4PRO DRIVER VERSION SELECTION

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



FIG 6 YDLIDAR X4PRO DRIVER INSTALLING

After the installation is complete, right-click on [My Computer] and select [Properties]. On the open [System] screen, select [Device Manager] from the left menu to access the [Device Manager].

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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 X4PRO and PC interconnection).

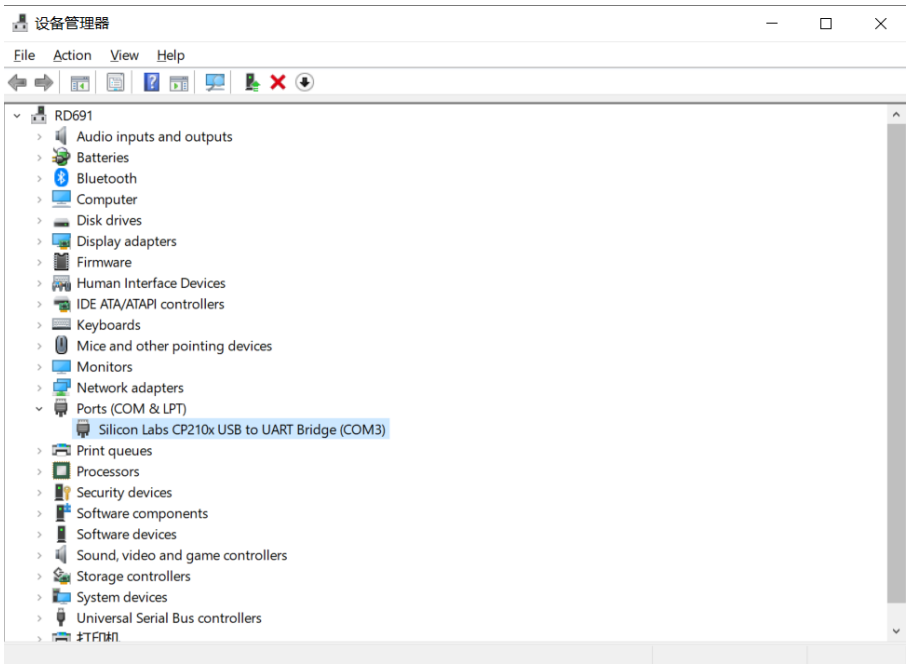


FIG 7 YDLIDAR X4PRO DRIVER INSTALLATION CHECK

2.3 Evaluation Software Usage

YDLIDAR provides Point Cloud Viewer, a point cloud data visualization software LidarViewer for X4PRO real-time scanning. Users can intuitively observe the X4PRO scanning effect chart. GDL real- time point cloud data and real-time scanning frequency are provided on YDLIDAR. At the same time, users can save the scanned data offline to an external file for further analysis. Visualization software download link: https://www.ydlidar.com/Public/upload/download/TOOL.zip

Before using the YDLIDAR software, make sure that the X4PRO USB adapter board serial port driver is installed successfully, and interconnect the X4PRO with the USB port of the PC. Run the evaluation software: LidarViewer.exe, select the corresponding serial port number and model number. Meanwhile, users could choose language on the top right corner.



FIG 8 YDLIDAR X4PRO EVALUATION SOFTWARE

Note：The X4PRO is shared with the X4 model.

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If the connection is correct, it will show the following screen：

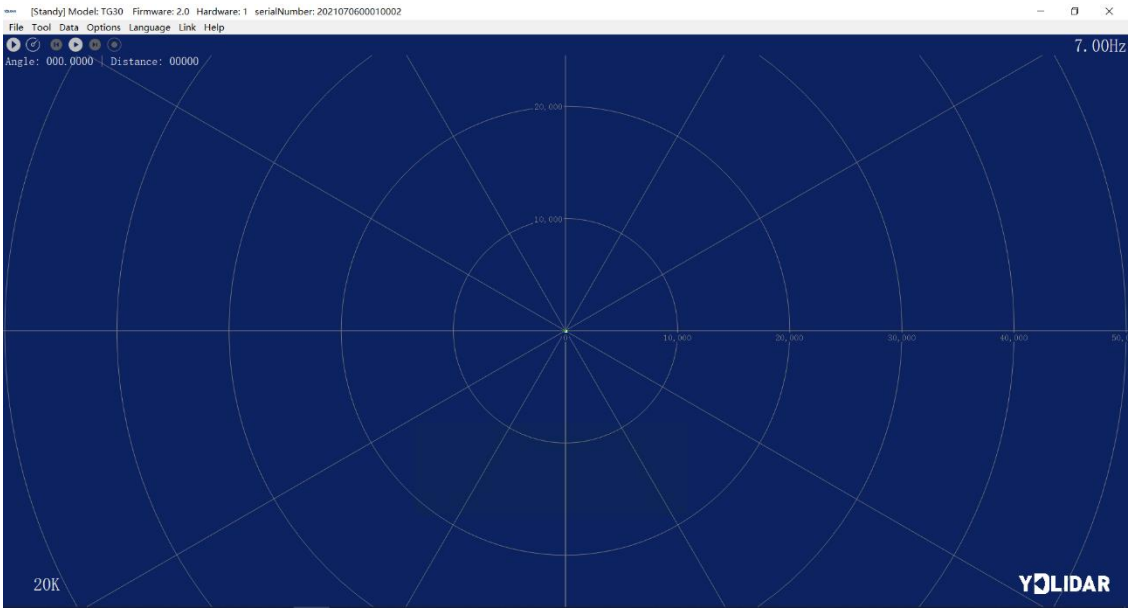


FIG 9 POINTCLOUD VIEWER INTERFACE

2.3.1 Start Scanning

Click to start scanning and display the environment point cloud, the upper left corner displays the angle & distance information of the red line position (unit: mm). Click to stop it. as shown below:

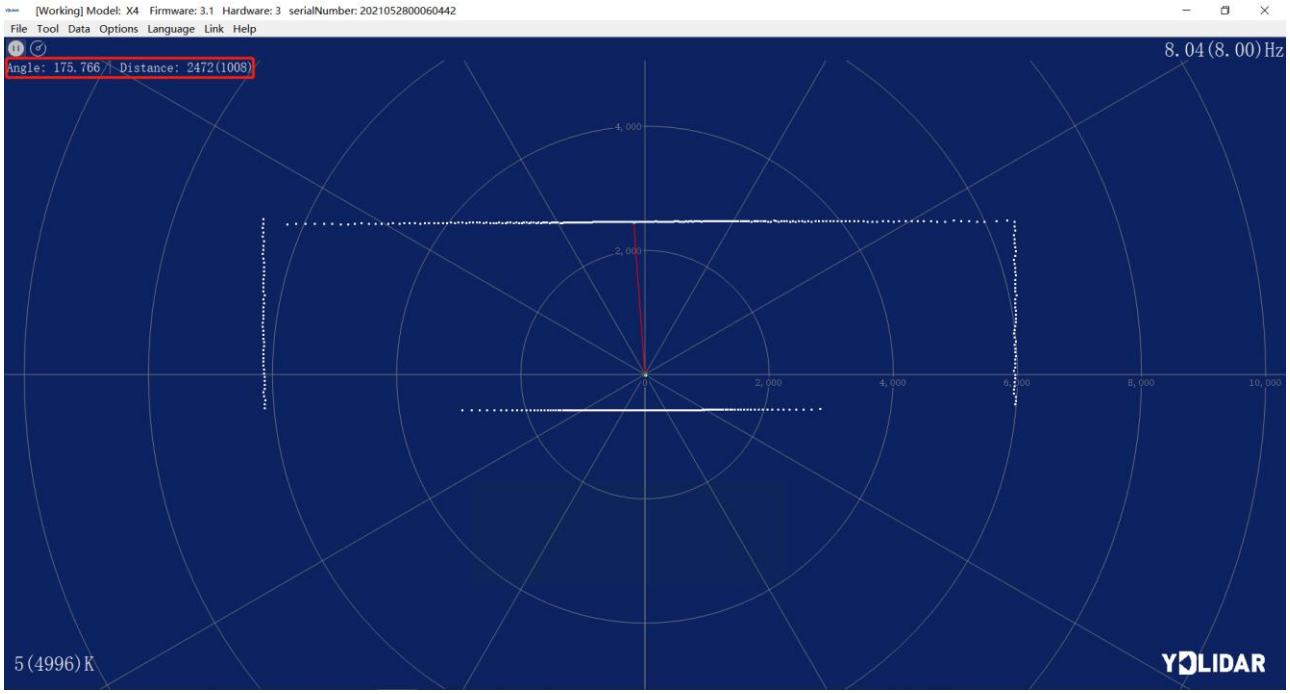


FIG 10 LIDAR SCANNING POINT CLOUD DISPLAY

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2.3.2 Data Storage

During lidar scanning, click [File] in the main menu, select [Export to Excel], and save point cloud data according to the prompts. Then the system will save the point cloud information scanned in a circle in Excel format.

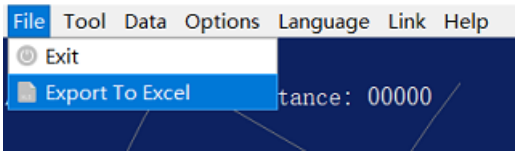


FIG 11 SAVE DATA

2.3.3 Display Mean and Standard Deviation

Click [Tools] in the main menu, then select [Mean And STD] - [View].

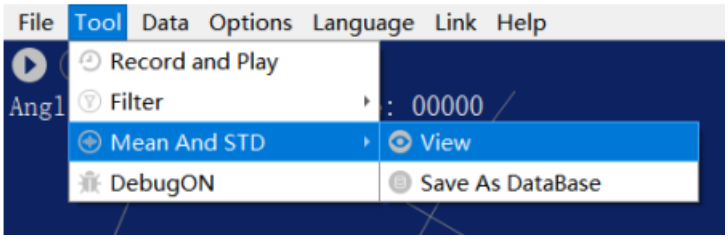


FIG 12 YDLIDAR G4 DISPLAY MEAN AND STANDARD DEVIATION

Choose one according to needs, move the mouse to the test position, right-click the pop-up menu, and select [Lock Mouse Tracking].

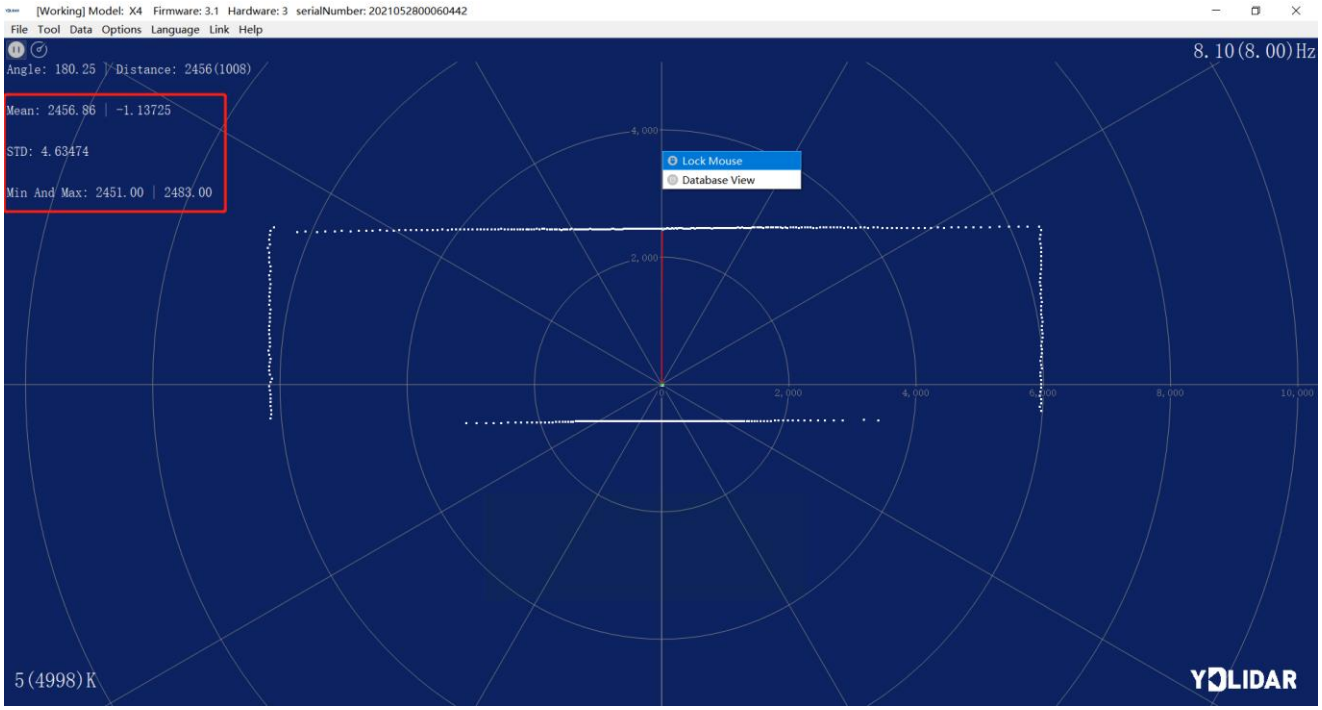


FIG 13 LOCK MOUSE TRACKING

2.3.4 Play and Record

Click [Tools] in the main menu, then select [Record and Play].

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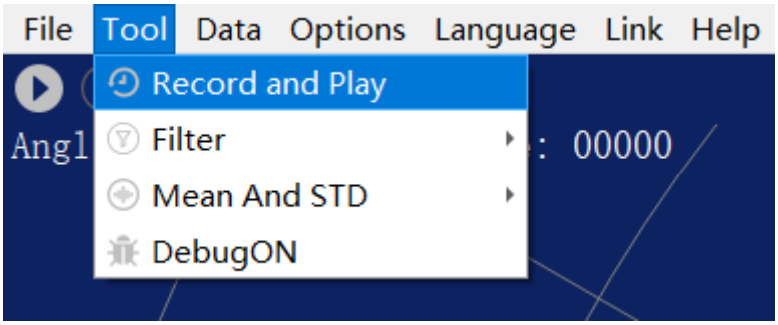


FIG 14 RECORD AND PLAY

The main window is displayed as follows:

To record lidar data, click to start recording, and click to stop recording.

In non-scanning mode, click to start play.

The play process is as follows:

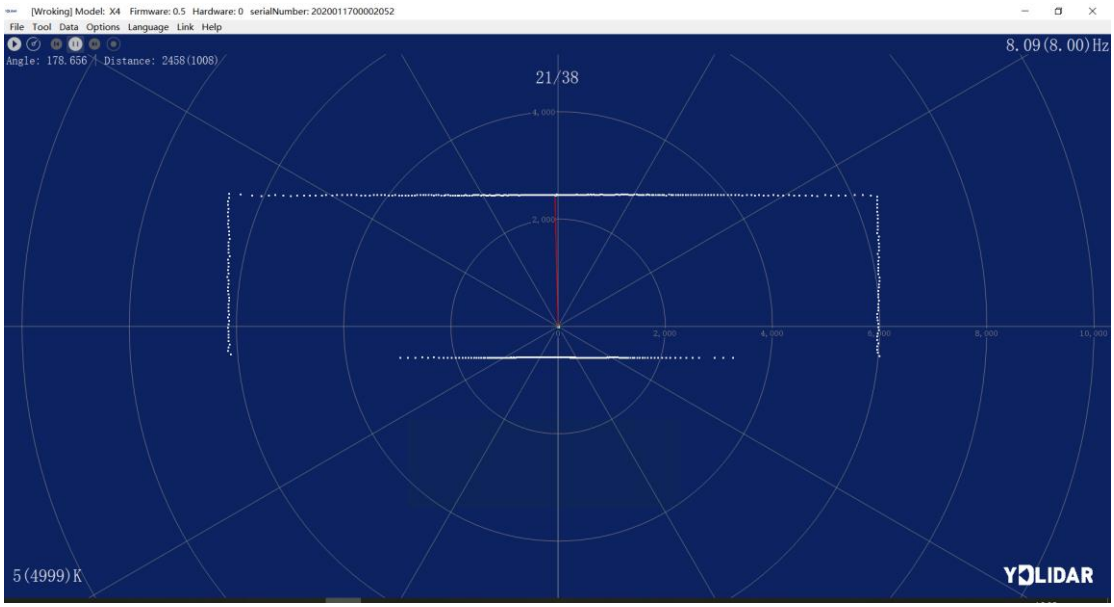


FIG 15 PLAY PROCESS

2.3.5 Debug

Click [Tools] in the main menu, and then select [DebugON] to output the raw lidar data to the "viewer_log.txt" and "viewer_log_err.txt" files.

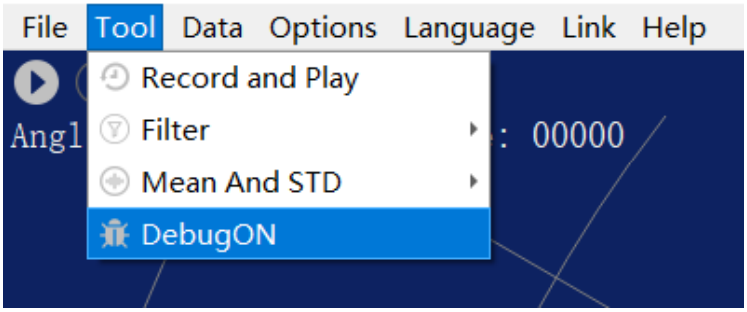


FIG 16 START DEBUGGING

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2.3.6 Filter

Click [Tools] in the main menu, and then select [Filter] to add lidar data filtering algorithm.

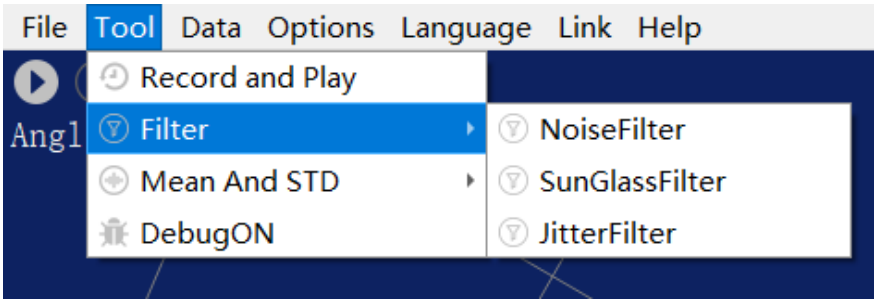


FIG 17 FILTER SETTING

Note: For more functions of LidarViewer, please click [Help], select [More Information], and learn more about how to use it.

3 LINUX ROS OPERATION

There are many Linux versions， this article only uses Ubuntu 18.04, Melodic version ROS as an example.

SDK driver address：

https://github.com/YDLIDAR/YDLidar-SDK

ROS driver address：

https://github.com/YDLIDAR/ydlidar_ros_driver

3.1 Device Connection

Under Linux, the X4PRO and PC interconnect processes are consistent with those under Windows. See Device Connection under Window.

3.2 Compile and Install YDlidar-SDK

YDLIDAR_ROS_DRIVER depends on the YDLIDAR-SDK library. If never installed the YDlidar-SDK library before, or it has expired, it is necessary to install the YDlidar-SDK library. If the system has installed the latest version of ydlidar-SDK, please skip this step, then go to the next step.

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```
$ git clone https://github.com/YDLIDAR/YDLidar-SDK.git

$ cd YDLidar-SDK/build

$ cmake ..

$ make

$ sudo make install
```

3.3 ROS Driver Installation

1) Cloning GitHub's YDlidar ROS Driver Package:

```
$ git clone https://github.com/YDLIDAR/ydlidar_ros_driver.git
ydlidar_ws/src/ydlidar_ros_driver
```

2) Build the Ydlidar_ROS_Driver software package:

```
$ cd ydlidar_ws

$ catkin_make
```

3) Package environment Settings:

```
$ source ./devel/setup.sh
```

Note: Add permanent workspace environment variables. It will be very convenient if ROS environment variables are automatically added to the bash session every time when start a new shell:

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

4) Verify that the package path is set, echo the ROS_PACKAGE_PATH variable.

```
$ echo $ROS_PACKAGE_PATH
```

It can be seen something like this: /home/tony/ydlidar_ws/src:/opt/ros/melodic/share

5) Create Serial Port Alias [Optional]

```
$ chmod 0777 src/ydlidar_ros_driver/startup/*

$ sudo sh src/ydlidar_ros_driver/startup/initenv.sh
```

Note: After completing the previous operation, re-insert the LIDAR again.

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3.4 Run the ydlidar_ros_driver

Run ydlidar_ros_driver with startup file, as shown below Note: (The X4PRO is shared with the X4.launch.)

```
$ roslaunch ydlidar_ros_driver X4.launch
```

3.5 RVIZ View Scan Results

Run the launch file and open rviz to view the X4PRO scan results, as shown in the figure below:

```
$ roslaunch ydlidar_ros_driver lidar_view.launch
```

Note: Take G4 as an example by default, if use other types of lidar, need to change lidar.launch in lidar_view.launch file to the corresponding **.launch file. (If X4PRO lidar is used, it needs to be changed to X4.launch)



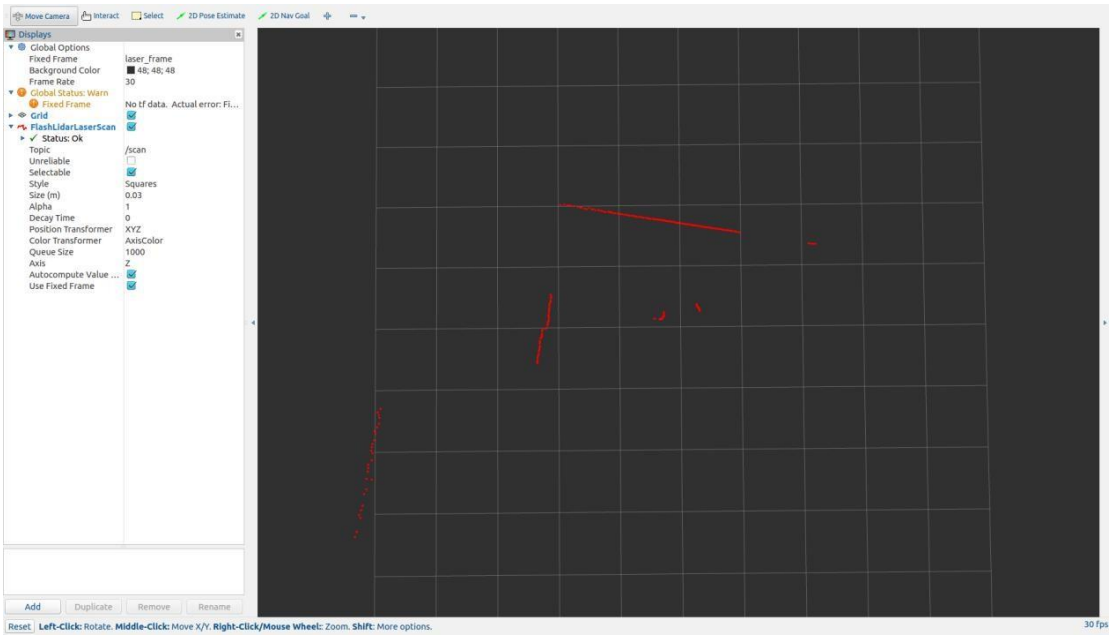


FIG 18 YDLIDAR X4PRO RVIZ

3.6 Modify Scan Angle

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

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1) Switch to the directory where the corresponding [launch file] is located, edit the file, and its content is as shown in the figure:

```
$ vim X4.launch
```

```
<launch>
  <node name="ydlidar_lidar_publisher"  pkg="ydlidar_ros_driver"  type="ydlidar_ros_driver_node" output="scree
n" respawn="false" >
    <!-- string property -->
    <param name="port"         type="string" value="/dev/ydlidar"/>
    <param name="frame_id"     type="string" value="laser_frame"/>
    <param name="ignore_array"     type="string" value=""/>

    <!-- int property -->
    <param name="baudrate"         type="int" value="512000"/>
    <!-- 0:TYPE_TOF, 1:TYPE_TRIANGLE, 2:TYPE_TOF_NET -->
    <param name="lidar_type"       type="int" value="0"/>
    <!-- 0:YDLIDAR_TYPE_SERIAL, 1:YDLIDAR_TYPE_TCP -->
    <param name="device_type"         type="int" value="0"/>
    <param name="sample_rate"         type="int" value="20"/>
    <param name="abnormal_check_count"         type="int" value="4"/>

    <!-- bool property -->
    <param name="resolution_fixed"    type="bool"   value="true"/>
    <param name="auto_reconnect"    type="bool"   value="true"/>
    <param name="reversion"    type="bool"   value="true"/>
    <param name="inverted"    type="bool"   value="true"/>
    <param name="isSingleChannel"    type="bool"   value="false"/>
    <param name="intensity"    type="bool"   value="false"/>
    <param name="support_motor_dtr"    type="bool"   value="false"/>
    <param name="invalid_range_is_inf"    type="bool"   value="false"/>

    <!-- float property -->
    <param name="angle_min"    type="double" value="-180" />
    <param name="angle_max"    type="double" value="180" />
    <param name="range_min"    type="double" value="0.01" />
    <param name="range_max"    type="double" value="50.0" />
    <param name="frequency"    type="double" value="10.0"/>
  </node>
  <node pkg="tf" type="static_transform_publisher" name="base_link_to_laser4"
    args="0.0 0.0 0.2 0.0 0.0 0.0 /base_footprint /laser_frame 40" />
</launch>
~
~                                                                    1,1           全部
```

FIG 19 X4 .LAUNCH FILE

Note: For more information about the file contents, please refer to:

https://github.com/YDLIDAR/ydlidar_ros_driver#configure-ydlidar_ros_driver-internal-parameter

2) The X4PRO 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 endangle. The specific scope needs to be modified according to actual use.

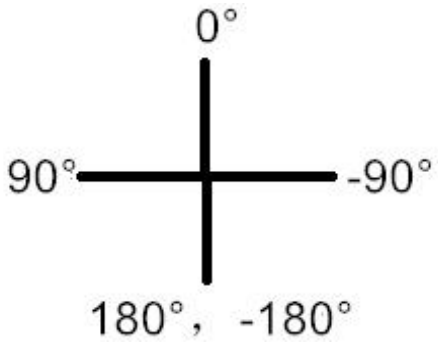


FIG 20 YDLIDAR X4PRO COORDINATES DEFINITION

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4 CAUTION

4.1 Ambient Temperature

When the working environment temperature of X4PRO is over high or over low, it will affect the accuracy of the distance measuring system. It may also damage the structure of the scanning system and reduce the service life of the X4PRO lidar. Avoid using in high temperature (>50 degrees Celsius) and low temperature (<0 degrees Celsius) conditions.

4.2 Ambient Lighting

The ideal working environment of X4PRO is indoor, and the indoor environment light (including no light) will not affect the work of X4PRO. However, please avoid using strong light sources (such as high-power lasers) to directly illuminate the X4PRO vision system.

If the user need to use it outdoors, please avoid the X4PRO's vision system directly facing the sun, which may cause permanent damage to the vision system's photosensitive chip, which will invalidate the range finding.

The X4PRO standard version will cause interference in the distance measurement under the conditions of strong sunlight reflection outdoors, please pay attention to it.

4.3 Power Supply

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 X4PRO, the external power supply of the +5V to the X4PRO needs to be provided through the USB_PWR interface of the USB interface board. It is not recommended for use mobile phone power bank because the voltage ripple of power bank is too large.

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5 REVISE

Date	Version	Content
2022-05-30	1.0	The 1st release

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