YDLIDAR X2
USER MANUAL

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1 YDLIDAR X2 LIDAR DEVELOPMENT KIT

The development kit of YDLIDAR X2 lidar (hereinafter referred to as X2) is an accessory tool provided for performance evaluation and early development of the X2. Through the X2 development kit, and with the evaluation software, users can observe point cloud data scanned by X2 on your environment or development on the SDK.

1.1 Development Kit

The X2 development kit has the following components:

![X2 Lidar](image1)
![USB Type-C Cable](image2)
![USB Adapter Board](image3)

**FIG 1 YDLIDAR X2 DEVELOPMENT KIT**

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2 Lidar</td>
<td>1</td>
<td>Standard version of the X2 lidar. The X2 has an integrated motor drive for despining control and motor control</td>
</tr>
<tr>
<td>USB Type-C Cable</td>
<td>1</td>
<td>Use with USB adapter board to connect X2 and PC. USB cable is both a power supply cable and a data cable</td>
</tr>
<tr>
<td>USB Adapter Board</td>
<td>1</td>
<td>Realize the function of USB to UART, which is convenient for the fast interconnection between X2 and PC. Serial port DTR signal to control X2 motor despining control, a Micro USB power interface (PWR) for auxiliary power supply is provided</td>
</tr>
</tbody>
</table>

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 X2 under windows, X2 and PC needed to be connected. The specific process is as follows:
Connect the adapter board with X2 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, and the X2 enters the idle mode after being powered on. The motor does not rotate.

The drive current of USB interface of some development platforms or PC is not sufficient. X2 need to be connected to the auxiliary power supply of +5V, otherwise the lidar will be abnormal.
2.2 Driver Installation

To evaluate and develop the X2 under Windows, the serial port driver of the USB adapter board. The USB adapter board need to be installed 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


After unzip 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.

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].

Double-click the exe file and follow the prompts to install it.
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 X2 and PC interconnection).

![FIG 7 YDLIDAR X2 DRIVER INSTALLATION CHECK](image)

### 2.3 Evaluation Software Usage

YDLIDAR provides Point Cloud Viewer, a point cloud data visualization software LidarViewer for X2 real-time scanning. Users can intuitively observe the X2 scanning effect chart. GDL real-time point cloud data and real-time scanning frequency are provided on YDLIDAR. At the same time, 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 X2 USB adapter board serial port driver is installed successfully, and interconnect the X2 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 X2 EVALUATION SOFTWARE](image)
If the connection is correct, you will see 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]
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](image)

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](image)

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](image)

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

![FIG 13 LOCK MOUSE TRACKING](image)
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:

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.
2.3.6 Filter

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

![Filter Setting](image)

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 X2 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 you have the latest version of ydlidar-SDK, please skip this step, then go to the next step.
3.3 ROS Driver Installation

1) Cloning GitHub's YDLidar ROS Driver Package:

   ```
   $ git clone https://github.com/YDLIDAR/YDLidar-SDK.git
   $ cd YDLidar-SDK/build
   $ cmake ..
   $ make
   $ sudo make install
   ```

2) Build the YDLidar_ROS_Driver software package:

   ```
   $ cd ydlidar_ws
   $ catkin_make
   ```

3) Package environment Settings:

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

   Note: Add permanent workspace environment variables. It will be very convenient if ROS environment variables are automatically added to your 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 see something like this: /home/tony/ydlidar_ws/src/opt/rostest/melodic/share

5) 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.

3.4 Run the ydlidar_ros_driver

Run ydlidar_ros_driver with startup file, as shown below:
3.5 RVIZ View Scan Results

Run the launch file and open rviz to view the X2 scan results, as shown in the figure below:

```
$ rosrun ydlidar_ros_driver X2.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 X2 lidar is used, it needs to be changed to X2.launch)

![Figure 18 YDLIDAR X2 RVIZ](image)

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, you need to modify the configuration parameters in the launch file. The specific operation is as follows:

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 X2.launch
```
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 X2 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.
4 CAUTION

4.1 Ambient Temperature

When the working environment temperature of X2 is overhigh or overlow, 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 X2 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 X2 is indoor, and the indoor environment light (including no light) will not affect the work of X2. However, please avoid using strong light sources (such as high-power lasers) to directly illuminate the X2 vision system.

If you need to use it outdoors, please avoid the X2'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 X2 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 X2, the external power supply of the +5V to the X2 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.
## 5 REVISE

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Content</th>
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<tbody>
<tr>
<td>2017-12-05</td>
<td>1.0</td>
<td>Composing a first draft</td>
</tr>
<tr>
<td>2018-01-22</td>
<td>1.1</td>
<td>Added auxiliary power connection method, document description,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>configuration description, and power supply requirements</td>
</tr>
<tr>
<td>2018-04-03</td>
<td>1.2</td>
<td>Adapt to PointCloudViewer2.0 client</td>
</tr>
<tr>
<td>2021-08-02</td>
<td>1.3</td>
<td>Adapt LidarViewer client, update SDK, ROS tutorial</td>
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