



INTRODUCTION TO LIDAR

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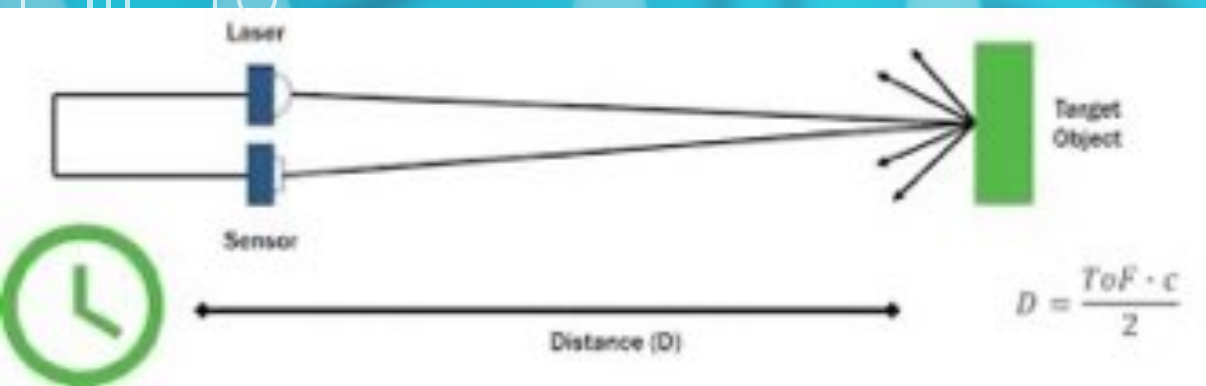
The background of the slide is a solid blue color. On the left side, there are white, stylized circuit lines and nodes. In the center, there is a faint, blurred image of a Raspberry Pi, showing its characteristic red and white colors and the text 'Raspberry Pi' and 'Model B' on its surface.

Content

- LiDAR Introduction and Definition
- Purpose, functionality and application of LiDAR
- RPLiDAR by Slamtech
- Setup on PC
- Setup on Raspberry Pi

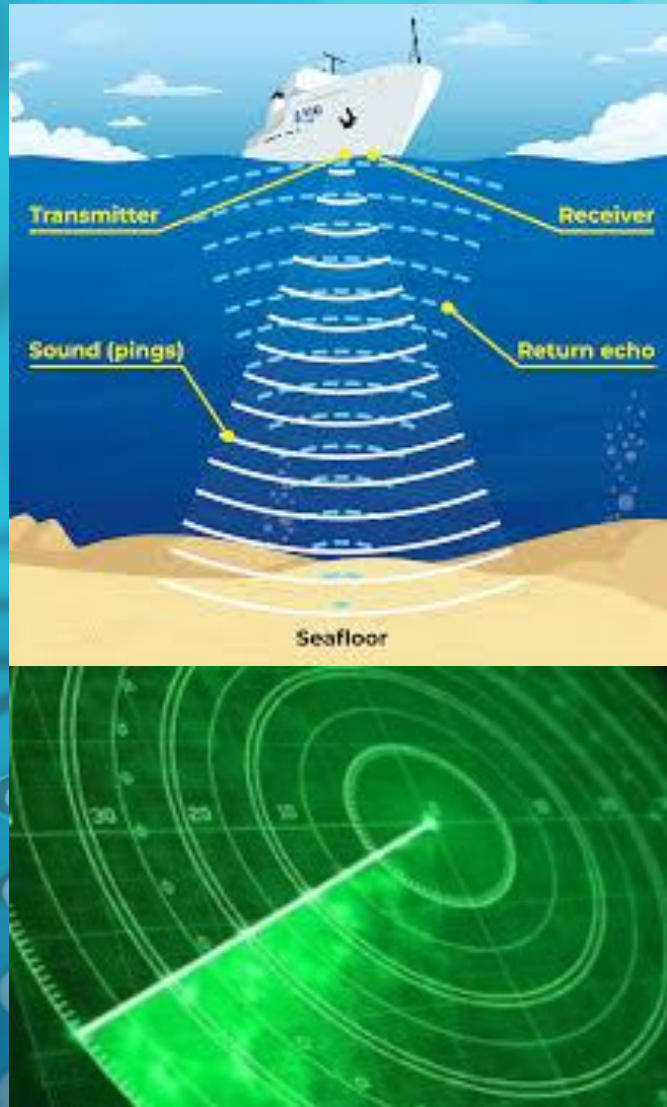


WHAT IS LIDAR?



Light Detection and Ranging.

A technology that is used to measure distances by emitting light pulses and measuring the time taken to receive of these pulses reflections off of objects.



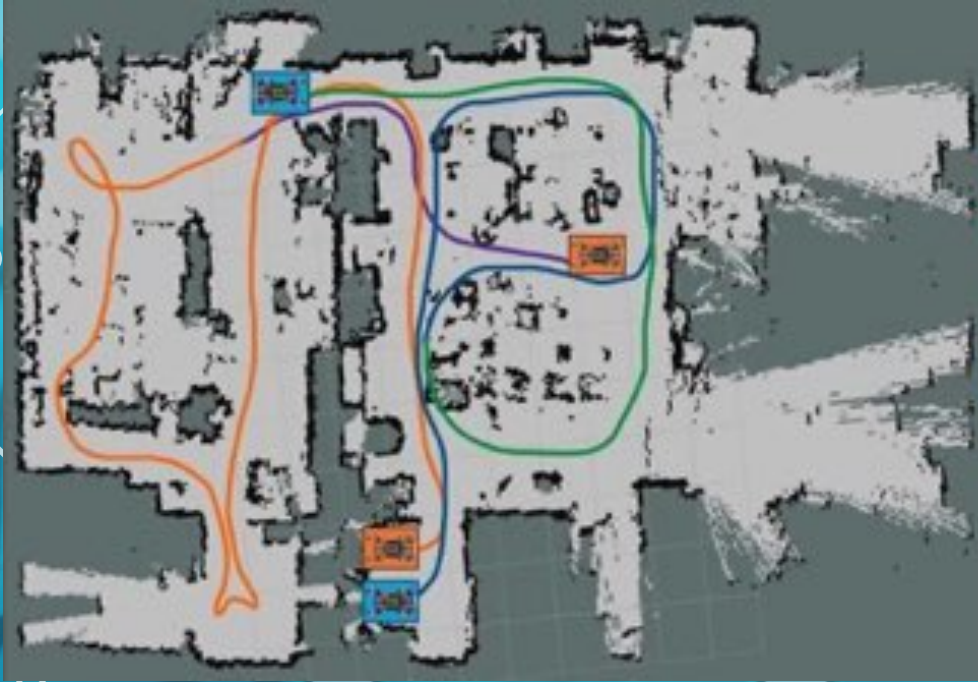
Similar technologies include:

- SoNAR
- RaDAR

Qn. Why use LiDAR over these?

The background is a vibrant blue with a subtle, stylized pattern of circuit traces and circular nodes, reminiscent of a printed circuit board (PCB). In the center, a black rectangular box with rounded corners contains the text in white. The text is arranged in four lines, centered horizontally.

WHAT IS THE PURPOSE OF
LIDAR IN THE
COMPETITION?



- Detection of walls during:
 - Mapping (SLAM)
 - Autonomous Navigation

The image features a dark blue background with a complex, glowing circuit pattern. The circuit lines are light blue and white, forming a dense network of paths and nodes. In the center, a black rectangular box with rounded corners contains the word "RPLIDAR" in white, bold, sans-serif capital letters. The overall aesthetic is high-tech and digital.

RPLIDAR



Stands for Robust and Precise LiDAR
Specifically using RPLiDAR a1 model
2D scanner

Head rotates at 5.5Hz

Sample rate of up to 8000 times per
second

Range of 0.15 to 12m



RPLiDAR α1



RPLiDAR α2



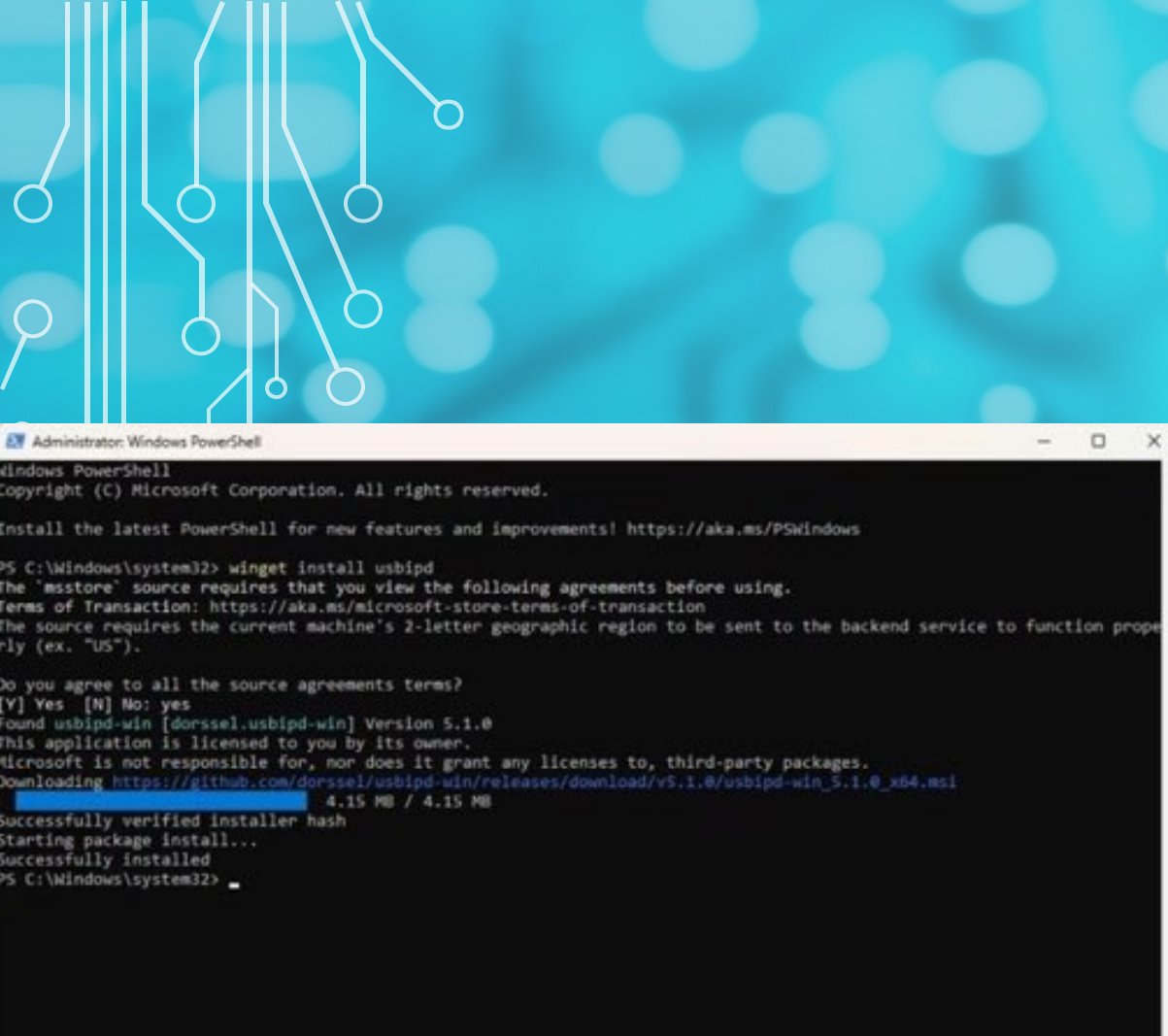
RPLiDAR α3



Feature	RPLIDAR A1	RPLIDAR A2	RPLIDAR A3
Model	A1M8	A2M12	A3M1
Dimensions	98.5mm x 70mm x 60mm	76mm x 76mm x 41mm	76mm x 76mm x 41mm
Weight	G.W 170g	G.W 190g	G.W 190g
Battery	Exclude	Exclude	Exclude
Distance Range	0.15 - 6m, White objects	0.2 - 12m, Based on white objects with 70% reflectivity	White object: 25 meters; Black object: 10 meters
Angular Range	0-360 Degree	0-360 Degree	0-360 Degree
Distance Resolution	<0.5mm	<0.5mm	N/A
Angular Resolution	≤1 Degree	0.225 degree	0.225° or 0.36°
Sample Duration	0.5ms	0.25ms	N/A
Sample Frequency	2000~2010Hz	16000Hz	16 kHz
Scan Rate	1-10Hz, Typical 5.5Hz	5-15Hz, Typical 10Hz	Typical value: 15 Hz (adjustable between 5 Hz-20 Hz)
Communication Interface	USB	USB	TTL UART
Typical Applications	Small-scale robotics, educational purposes, hobbyist applications	Robotics navigation, 3D mapping, terrain modeling, industrial automation	Autonomous vehicles, drone navigation, industrial robotics, high-performance applications

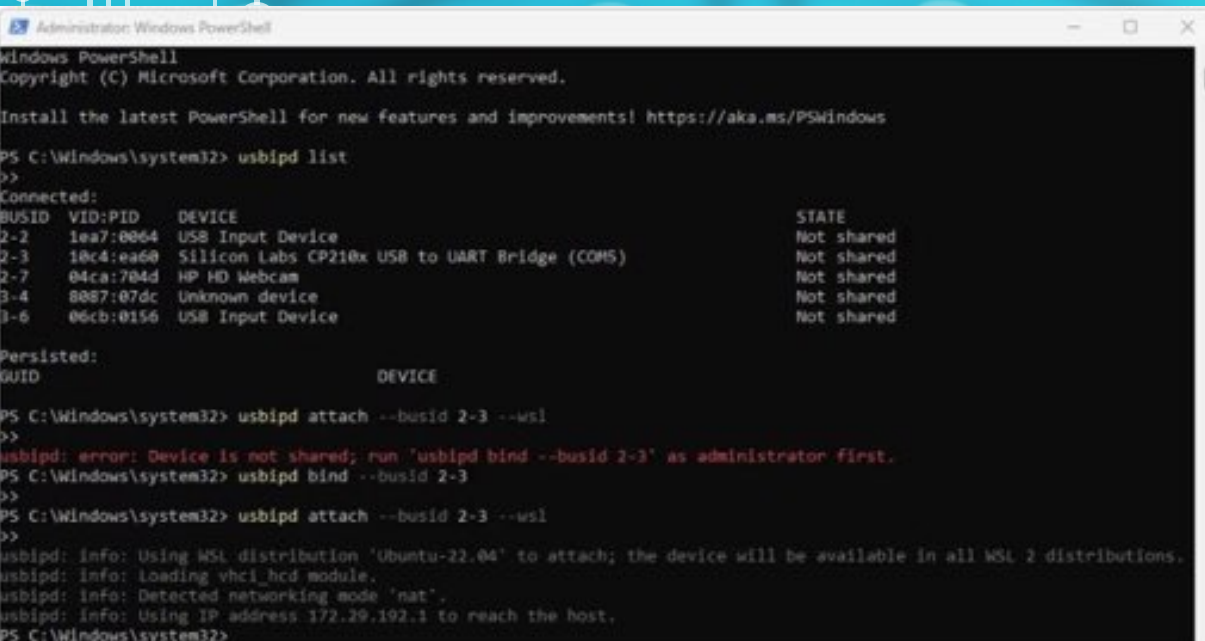


RPLIDAR SETUP ON PC



Connect the RPLiDAR to the PC via USB
On Windows PowerShell:

- Install `usbipd`. This is a tool that enables sharing of USB devices over networks.
- Run `winget install usbipd`
- Restart your PC



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

[Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows]

PS C:\Windows\system32> usbipd list
>>
Connected:
BUSID  VID:PID  DEVICE                                STATE
-----
2-2    1ea7:0064  USB Input Device                      Not shared
2-3    10c4:ea60  Silicon Labs CP210x USB to UART Bridge (COM5)  Not shared
2-7    04ca:704d  HP HD Webcam                          Not shared
3-4    8087:07dc  Unknown device                        Not shared
3-6    06cb:0156  USB Input Device                      Not shared

Persisted:
GUID                                DEVICE
-----
PS C:\Windows\system32> usbipd attach --busid 2-3 --wsl
>>
usbipd: error: Device is not shared; run 'usbipd bind --busid 2-3' as administrator first.
PS C:\Windows\system32> usbipd bind --busid 2-3
>>
PS C:\Windows\system32> usbipd attach --busid 2-3 --wsl
>>
usbipd: info: Using WSL distribution 'Ubuntu-22.04' to attach; the device will be available in all WSL 2 distributions.
usbipd: info: Loading vhci_hcd module.
usbipd: info: Detected networking mode 'nat'.
usbipd: info: Using IP address 172.29.192.1 to reach the host.
PS C:\Windows\system32>
```

Start another PowerShell session.

Share COM5 to allow access of USB/IP to WSL

- Run `usbipd list`
- Note the bus ID (BUSID) with COM5 (usually 2-3)
- Run `usbipd bind --busid 2-3`
- Run `usbipd attach --busid 2-3 --wsl`



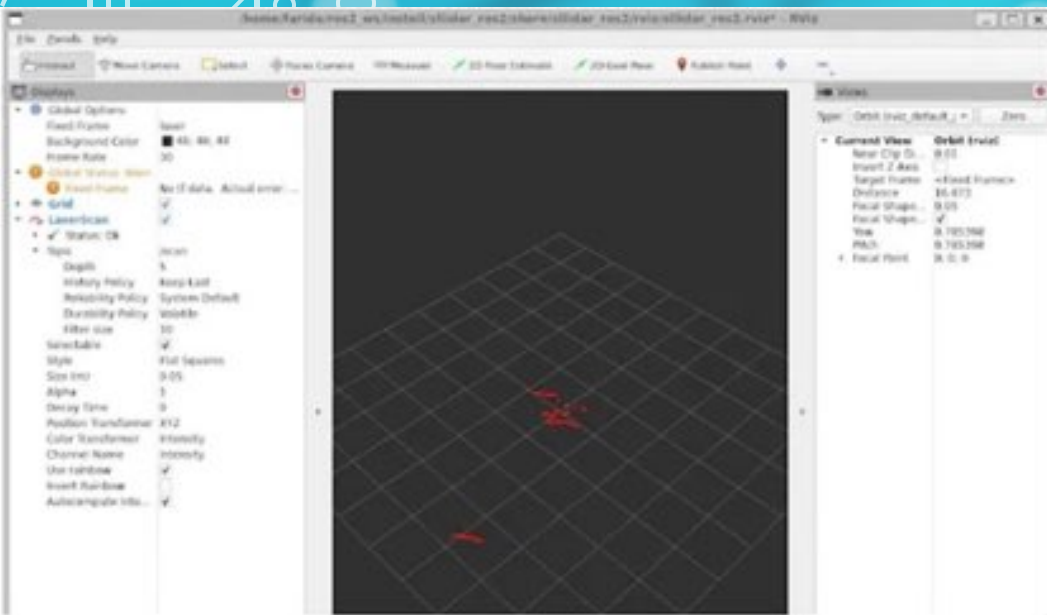
On WSL, run `ls /dev/ttyUSB*`

You should be able to see an output port
such as `/dev/tty/USB0`

The background of the slide is a blue gradient with a white circuit board pattern on the left side. The pattern consists of vertical lines with circles at the ends, representing components or nodes, and horizontal lines connecting them. The right side of the slide is a solid blue color.

Clone the Slamtec sllidar_ros2 repository from github into a workspace within WSL

- `mkdir -p ros2_ws/src`
- `cd ~/ros2_ws/src`
- `git clone https://github.com/Slamtec/sllidar_ros2.git`
- `cd ~ros2_ws`
- `colcon build`
- `source install/setup.bash`



Finally, run:

- `ros2 launch sllidar_ros2 view_sllidar_a1_launch.py serial_port:=/dev/ttyUSB0`

RViz will automatically open and the LiDAR output be visible as red dots within the Rviz grid.

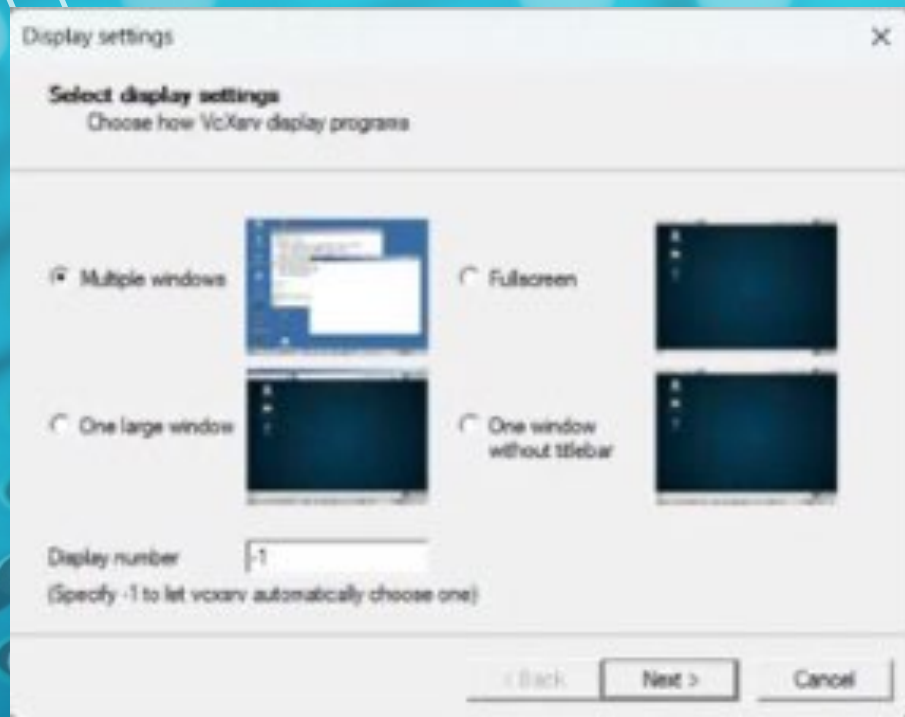


RPLIDAR SETUP ON RASPBERRY PI

X11 forwarding



- It is a method used to remotely run graphical applications on a Linux system and view the output on a separate display such as a local PC.
- This is achieved by running a server called an X server locally on the PC.



ON PC

VcXsrv is the recommended X-server for Windows users.

- Download the installer from sourceforge.net and run it to install VcXsrv
- Search for Xlaunch and open it


The background of the slide is a blue gradient with a white circuit board pattern. The pattern consists of various lines, circles, and dots, resembling a printed circuit board (PCB) layout. The lines are of different thicknesses and are connected to small circles, some of which are larger than others. The overall effect is a technical, digital aesthetic.

Ensure the following options are chosen as you go select 'next':


- Multiple Windows
- Start no client
- Clipboard
- Primary selection
- Native opengl
- Disable access control, then select 'Finish'.

ON RASPBERRY PI

- Access the Raspberry Pi on your PC by running `ssh raspberry@pi.local`
- Open a file called `sshd_config` by running `sudo nano /etc/ssh/sshd_config`
- Scroll to the of the code in the file with the text `#X11 Forwarding no` or similar. Uncomment the line by deleting the `#` and change it to `X11 Forwarding yes`. Save and exit

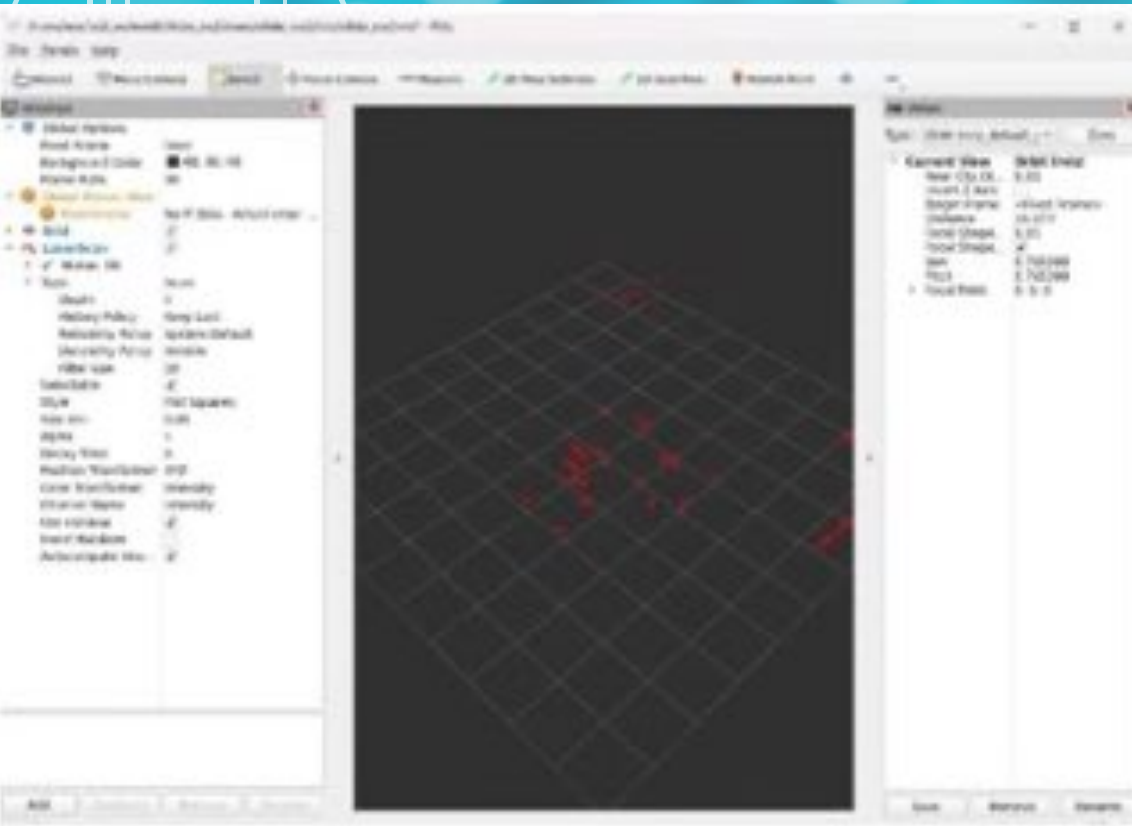


Run the command `export`
`DISPLAY=PC_IP_Address:0`, replacing
`PC_IP_Address` with your PC's IP address. You could
get your PC's IP address by running `ipconfig` on a
Windows CMD terminal. The address is usually
under `IP4V` at `Wireless LAN adapter Wi-Fi`

The background of the slide is a blue gradient with a white circuit board pattern on the left side. The circuit lines are thin and white, with small circles at the junctions and endpoints. The pattern is more dense on the left and fades towards the right.

Clone the Slamtec sllidar_ros2 repository from github into a workspace within the Raspberry Pi

- `mkdir -p ros2_ws/src`
- `cd ~/ros2_ws/src`
- `git clone https://github.com/Slamtec/sllidar_ros2.git`
- `cd ~ros2_ws`
- `colcon build`
- `source install/setup.bash`



Confirm the port where your LiDAR is connected by running `ls /dev/tty/USB*`

Finally, run:

```
ros2 launch sllidar_ros2  
view_sllidar_a1_launch.py  
serial_port:=/dev/ttyUSB0
```

RViz will automatically open and the LiDAR output be visible as red dots within the Rviz grid.

References:

- [RPLiDAR Setup on Windows PC](#)
- [RPLiDAR setup on Headless Raspberry Pi](#)
- [Troubleshooting Tips When Setting Up the RPLiDAR a1](#)
- [X11 Forwarding](#)

The image features a vibrant blue background with a subtle, intricate pattern of circuit board traces and circular nodes, reminiscent of a microchip or a digital network. In the center, a solid black rectangle with rounded corners serves as a focal point. Inside this rectangle, the words "THANK YOU" are written in a clean, white, sans-serif font, centered both horizontally and vertically. The overall aesthetic is modern and technological.

THANK YOU