ROS

ROS FOR BEGINNERS
BASICS, MOTION AND OPENCV

ANIS KOUBAA

Laser Scanners

Laser Scanners

▸ Device that can measure the distance to obstacles

▸ Uses laser beams

▸ Used for several robotics applications

▸ SLAM: building maps

▸ Obstacle avoidance

▸ Navigation

Reference: https://www.hermary.com/learning/principles-of-laser-triangulation/

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Robotics & Internet-of-Things

ROS

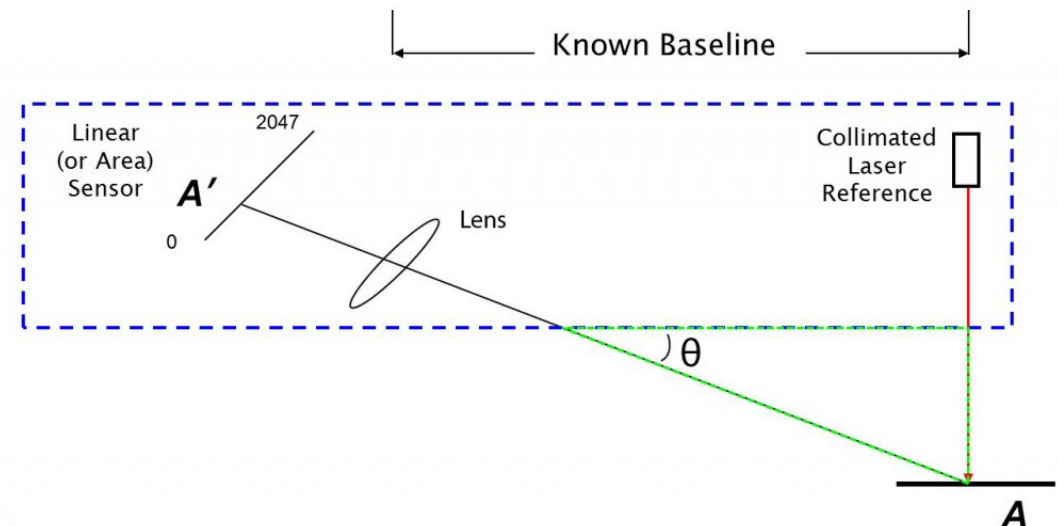## ROS FOR BEGINNERS
BASICS, MOTION AND OPENCV

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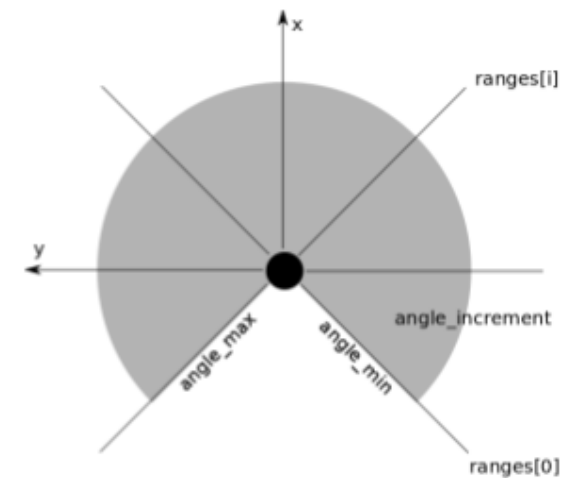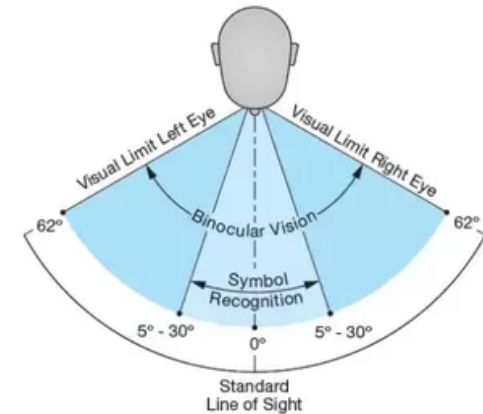## Laser Range Finder Characteristics

Laser Scanners Characteristics

▸ **Minimum angle:** start angle of the scan

▸ **Maximum angle:** end angle of the scan

▸ **Angle increment (angular resolution):** angular distance between measurements

▸ **Time increment:** time between measurements

▸ **Scan time:** time between two scans

▸ **Minimum range:** minimum observable range value

▸ **Maximum range:** maximum observable range value

▸ **List of ranges:** list of all measurements in a scan

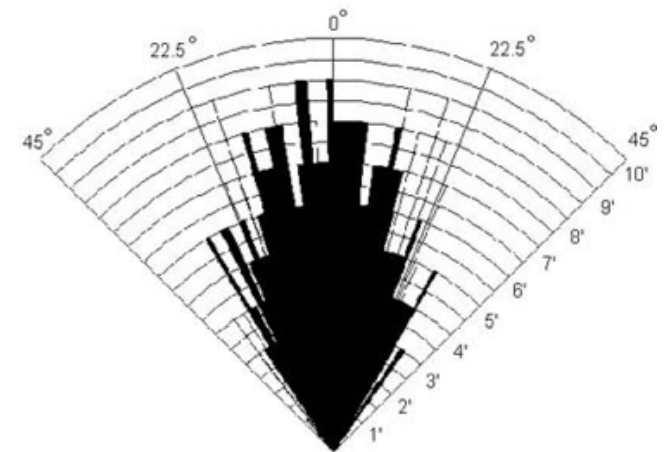▸ **List of intensities:** list of all intensities in a scan

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Laser Scanners Characteristics

▸ **Minimum angle:** start angle of the scan

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▸ **Minimum range:** minimum observable range value

▸ **Maximum range:** maximum observable range value

▸ **List of ranges:** list of all measurements in a scan

▸ **List of intensities:** list of all intensities in a scan

ranges = [1.2, 1.3, 2.0, ...

4.2, 2.4, 2.6, ...]

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Commercial Laser Range Finder Devices

2020

Commercial Laser Scanners

Hokuyo URG-04LX-UG01

▸ Max range: 01 - 5.6 m

▸ Max field of view: 240 [-120, 120]

▸ Environment: Indoor

▸ Scan frequency: 10 Hz (100 msec/scan)

▸ Voltage: 5V@0.5A

▸ Interface: USB 2.0

▸ Price: + 1000 USD

RPLIDAR A2

▸ Max range: 0.15 - 6 m

▸ Max field of view: 360 [-180, 180]

▸ Environment: Indoor

▸ Scan frequency: 10 Hz

▸ Voltage: 5V@0.45A

▸ Interface: UART

▸ Price: + 470 USD

Commercial Laser Scanners

SICK LMS151

- Max range: 0.5 - 20 m
- Max field of view: 270 [-135, 135]
- Environment: Outdoor
- Scan frequency: 25 Hz / 50 Hz
- Voltage: 10.8 - 30 VDC
- Interface: Ethernet, Serial, CAN-Bus
- Price: + 5200 USD

Hokuyo UTM-30LX

- Max range: 1.0 - 30 m
- Max field of view: 270 [-135, 135]
- Environment: Outdoor
- Scan frequency: 40 Hz (25 msec/scan)
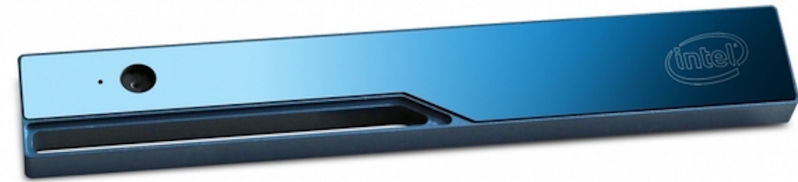- Voltage: 12V@0.7A
- Interface: USB 2.0
- Price: + 4700 USD

Commercial Laser Scanners

Orbbec Astra S

- Max range: 0.5 - 8 m
- Max field of view: 60° horiz. x 49.5 ° vert x 70 ° diag
- Environment: Indoor
- Depth Image Size: 640*480 (VGA) 16bit @30 FPS
- Voltage: 5V
- Interface: USB 20.
- Price: + 170 USD

Intel® RealSense™ Camera R200

- Max range: 0.5 - 3.5 m
- Max field of view: 60° horiz. x 49.5 ° vert x 70 ° diag
- Environment: Indoor
- Scan frequency: 40 Hz (25 msec/scan)
- Voltage: 5V
- Interface: USB 3.0
- Price: + 170 USD

Commercial Laser Scanners

LIDAR-Lite v3

▶ compact optical distance measurement sensor

▶ Max range: 0 - 40 m

▶ Power: 4.75–5V DC; 6V Max

▶ Environment: Indoor/Outdoor

▶ Optical Aperture: 12.5mm

▶ Interface: I2C or PWM

▶ Rate: 1–500Hz

▶ Price: + 130 USD

ROS

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Starting an RGBD Camera as Laser Scanner

(Asus Live Pro)

https://www.udemy.com/user/anis-koubaa/

2020

RGBD Cameras

Asus Live Pro

depth_image_to_laser.launch

```
<launch>
<node  name="depthimage_to_laserscan"  pkg="depthimage_to_laserscan"
type="depthimage_to_laserscan">
   <remap  from="image"  to="/camera/depth/image_raw"/>
</node>
</launch>
```

▸ Start Openni Package

   ▸ `roslaunch openni2_launch openni2.launch`

▸ Convert Depth Image to Laser Scanner

   ▸ `roslaunch ros_essentials_cpp depth_image_to_laser.launch`

▸ Open with rviz and test with rostopic echo

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Connect a Laser Range Finder

(Hukoyo URG-04LX)

https://www.udemy.com/user/anis-koubaa/

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Laser Range Finder Hukoyo URG 04-LX

▸ Start the drivers of the laser scanner

▸ Make sure that `/scan` topic is available

▸ Write a node that subscribes to the /scan topic

▸ Write a callback function that receive /scan messages and process them (min, max, average, ⋯)

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Laser Range Finder Hukoyo URG 04-LX

Hokuyo URG-04LX-UG01

▸ Start urg_node Package

- ▸ `rosrun urg_node urg_node`

▸ create a TF Transform between /map and /laser frame

- ▸ `rosrun tf static_transform_publisher 0.0 0.0 0.0 0.0 0.0 0.0 1.0 map laser 10`

▸ Open with rviz and test with rostopic echo

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