ENGR 4421: Robotics II

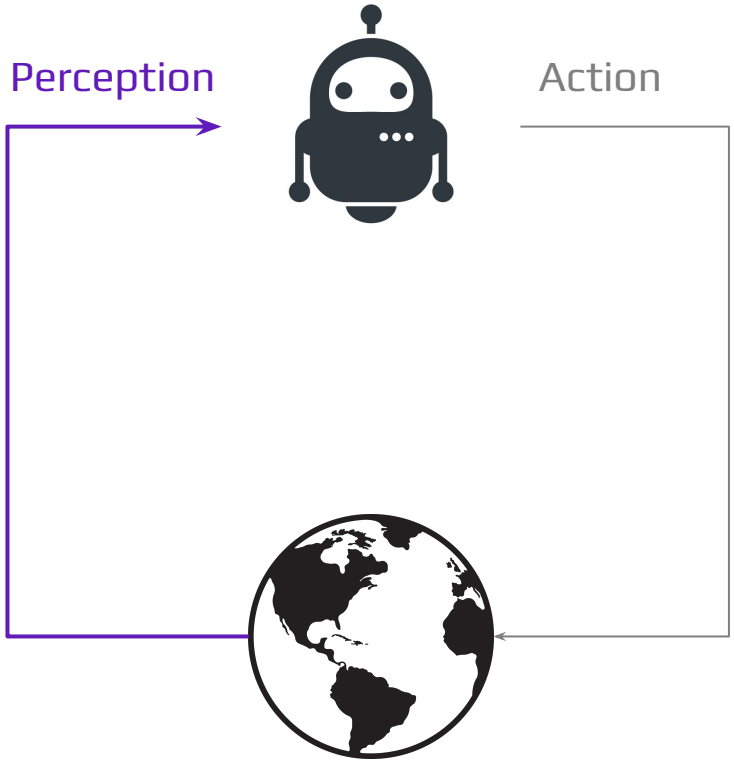
LiDAR

02/24/2026

Outline

- LiDAR Introduction
- RPLIDAR A1

A Robot Needs 360 degree sense



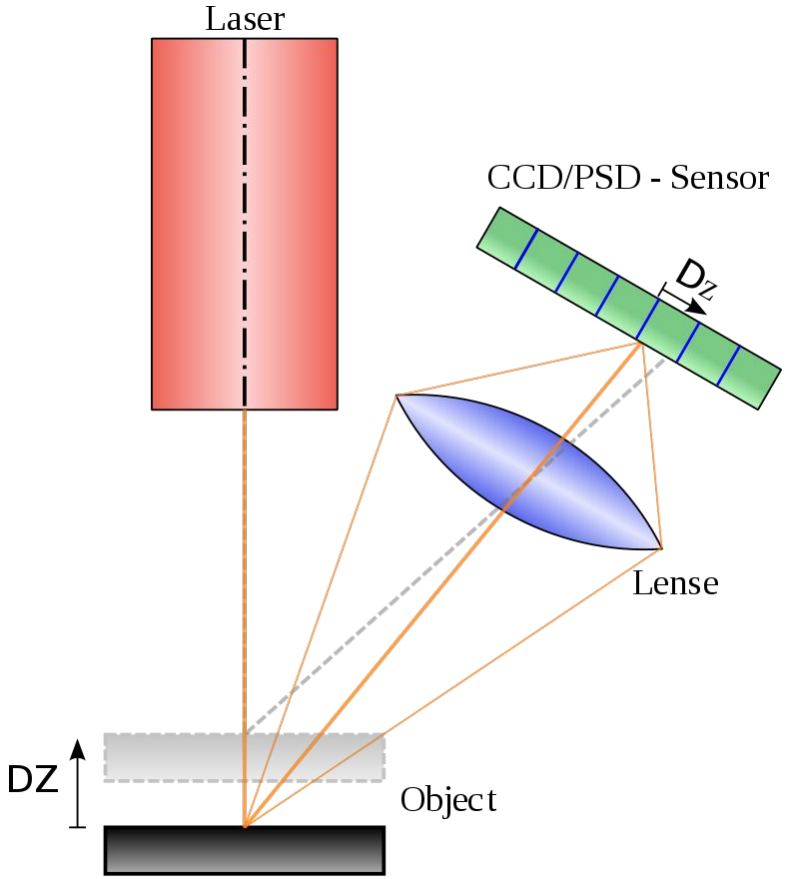
What is LiDAR

- Is the acronym of “Light Detection And Ranging”.
- Is a(nother) method to measure distances.
- Functions by sending out light beams and measuring the reflected signal.

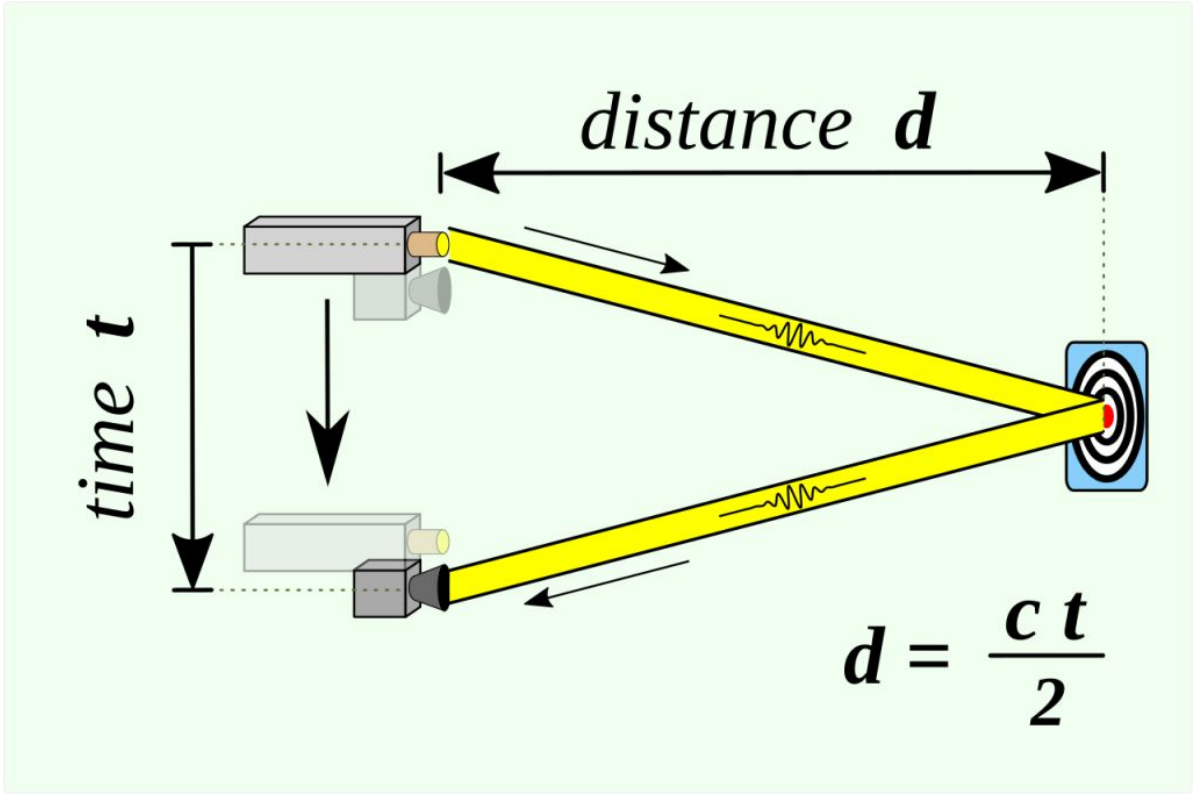
Approaches of Ranging

- Triangulation
- Time-of-flight (TOF)
- Phase shift

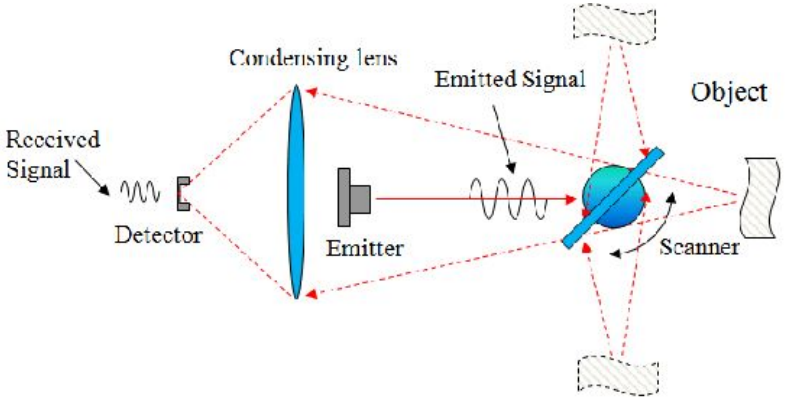
Triangulation

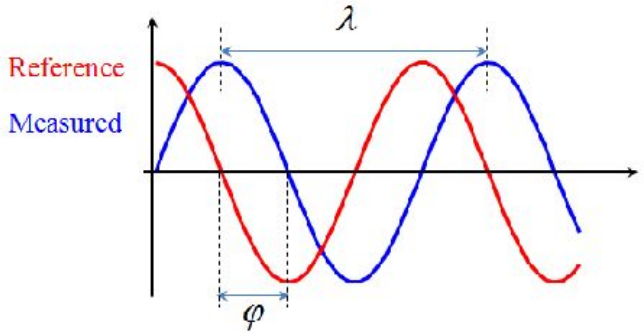


Time Of Flight

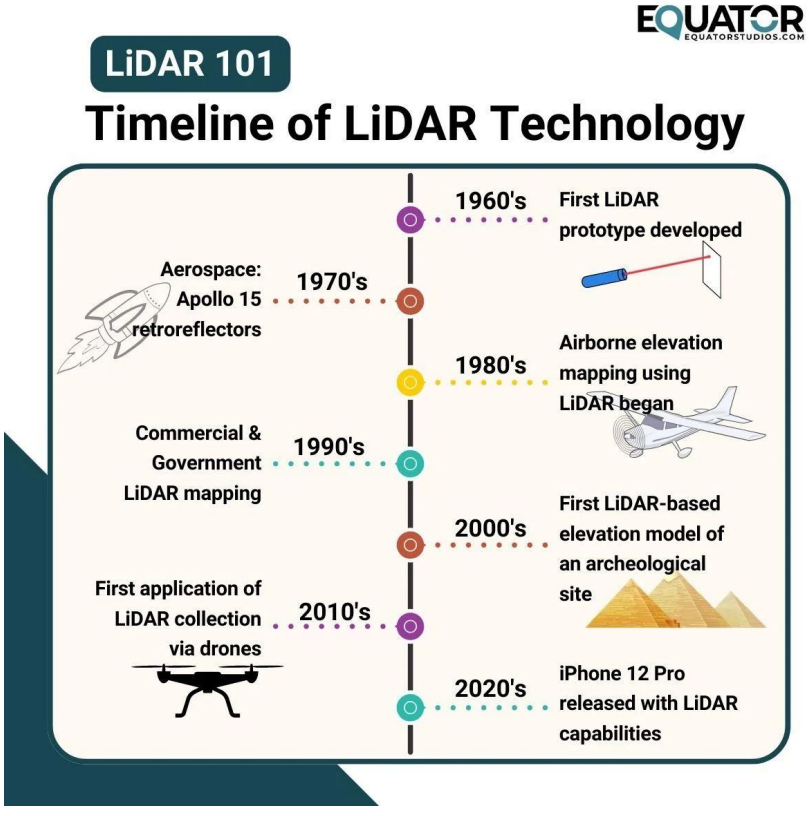


Phase Shift


Condensing lens
Emitted Signal
Object
Received
Signal
Detector
Emitter
Scanner


λ
Reference
Measured
φ

LiDAR History



LiDAR Applications

- Surveying
- Archaeology
- Forestry
- Farming
- Mining
- Autonomous Driving

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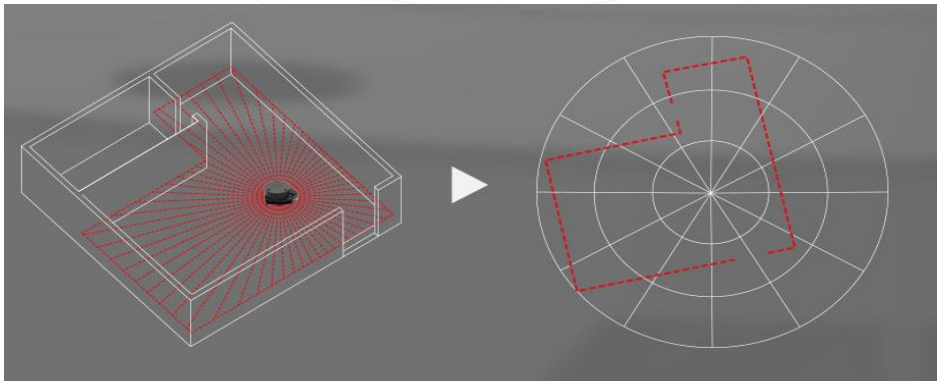
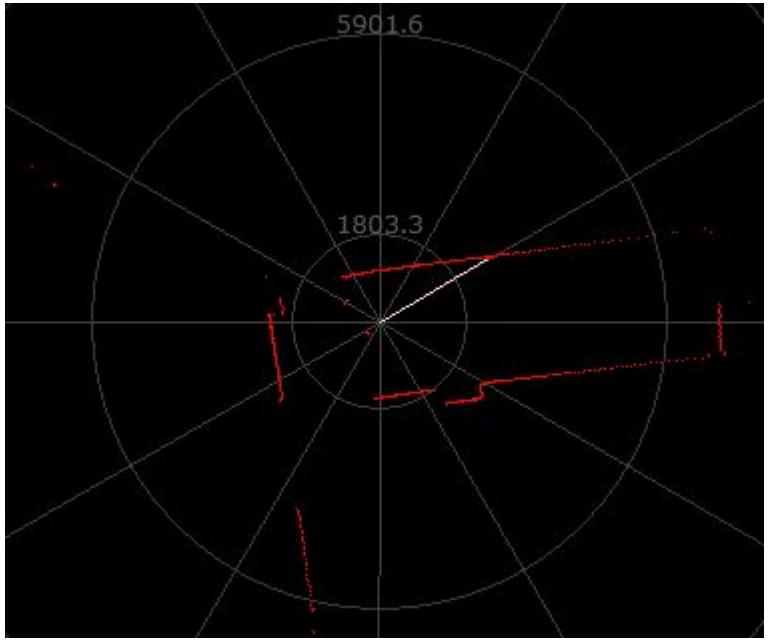
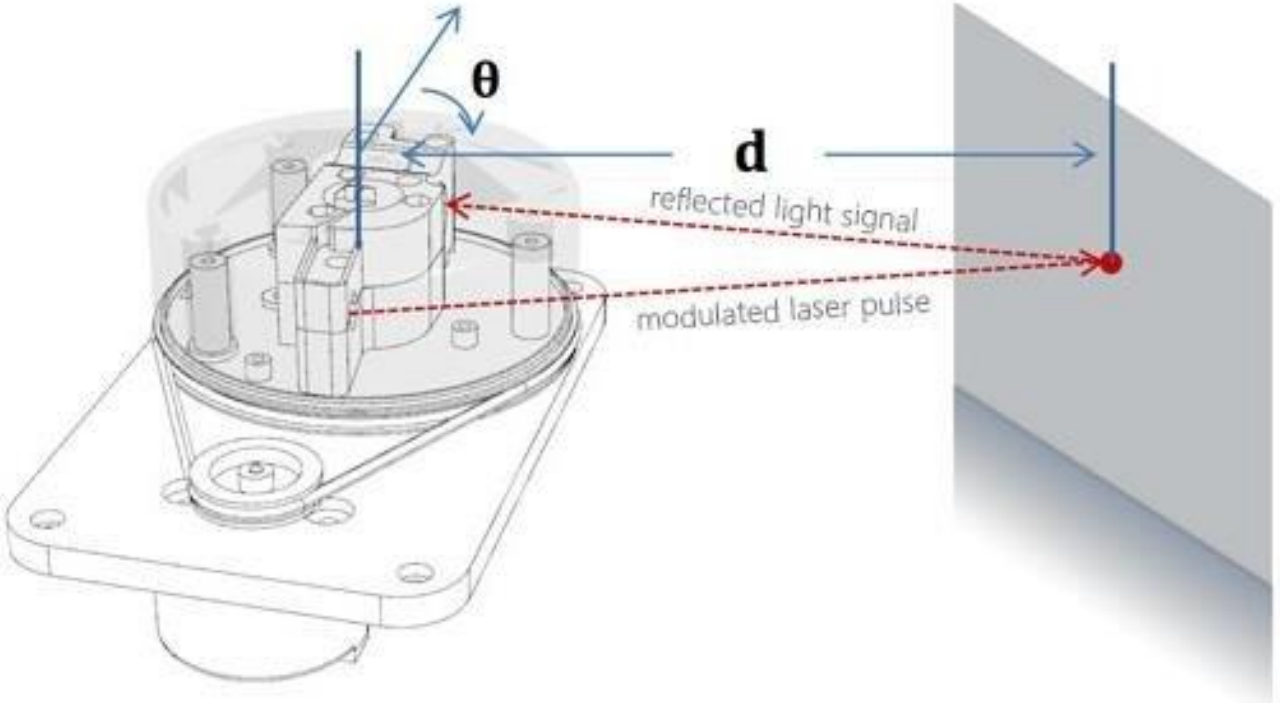
RPLIDAR A1





RPLIDAR A1's Triangulation

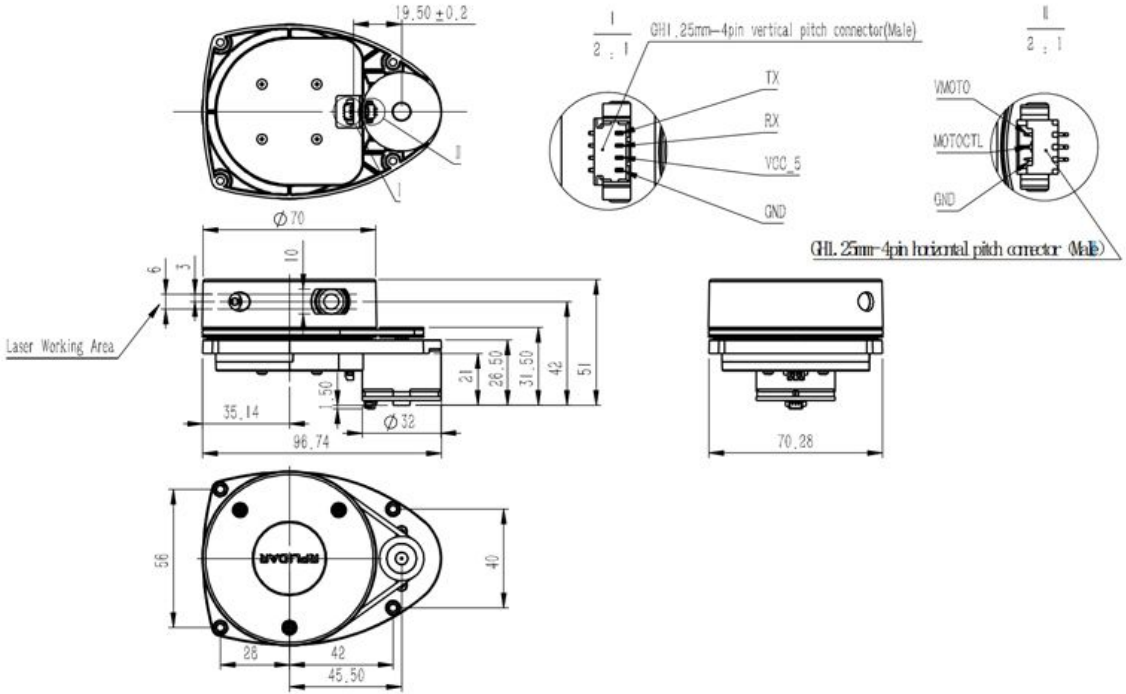


RPLIDAR A1 Specifications

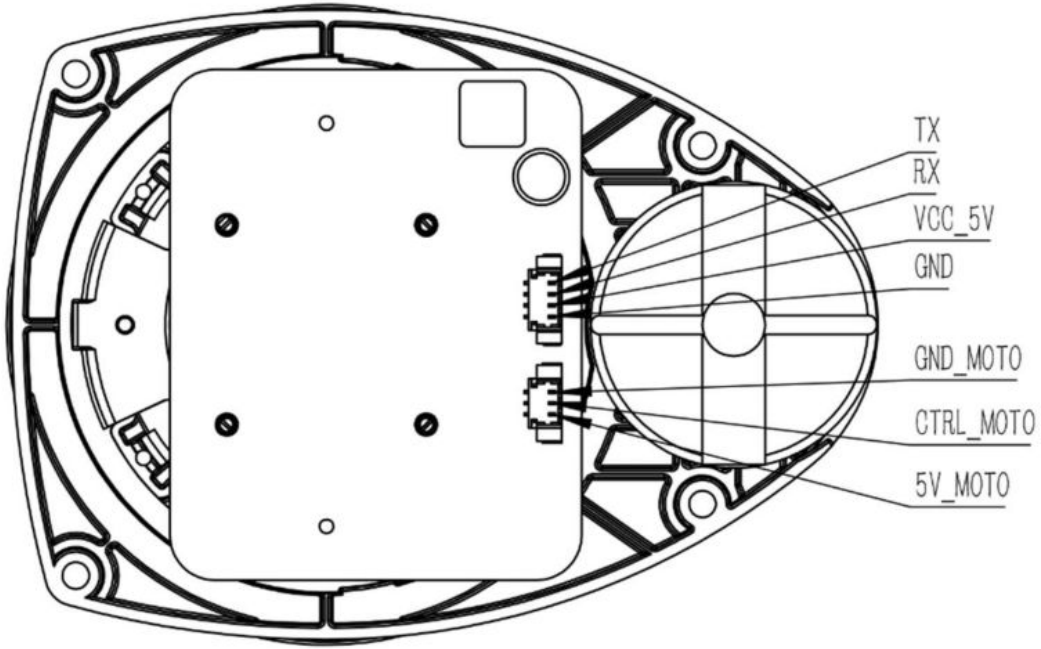
Measuring Range	**0.15m - 12m**
Sampling Frequency	8K
Rotational Speed	5.5Hz (up to 10 Hz)
Angular Resolution	≤1°
System Voltage	5V
System Current	100mA
Output	UART Serial (3.3 voltage level)
Temperature Range	0℃-40℃
Accuracy	1% of the range(≤3 m) 2% of the range(3-5 m) 2.5% of the range(5-25m)

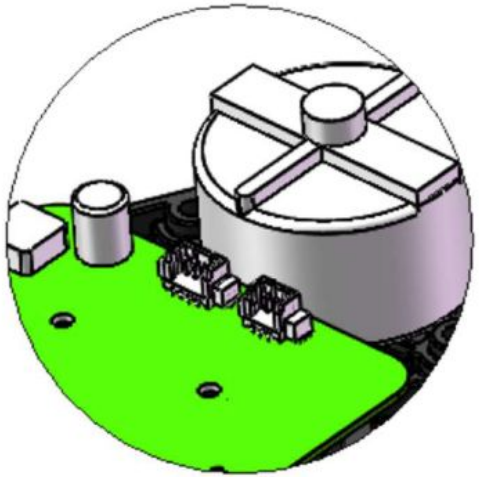
RPLIDAR A1 Dimensions

Size



RPLIDAR A1 Pinout





RPLIDAR A1 Versions

New(A1M8-R6)

Old(A1M8-R5)

Adafruit_CircuitPython_RPLIDAR

```
from math import floor
from adafruit_rplidar import RPLidar

# Setup the RPLidar
lidar = RPLidar(None, '/dev/ttyUSB0', timeout=3)
scan_data = [0]*360
# Print ranges
try:
    for scan in lidar.iter_scans():
        for (_, angle, distance) in scan:
            scan_data[min([359, floor(angle)])] = distance
        print(scan_data)
except KeyboardInterrupt:
    print('Stopping.')
lidar.stop()
lidar.disconnect()
```