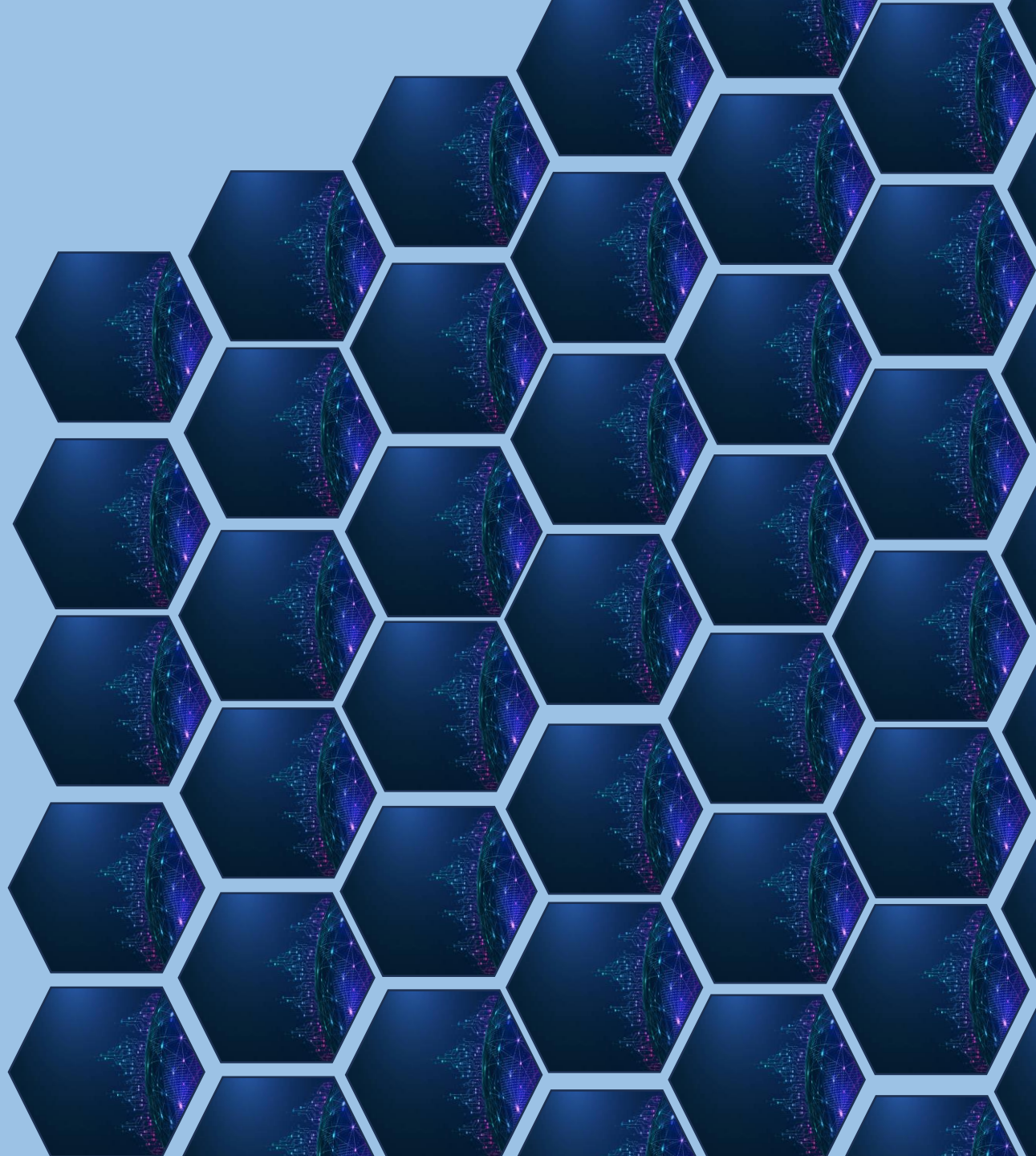
11

ROBOTICS CORNER

Robotics Corner

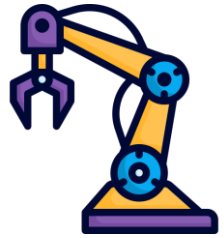
ROS for Professionals



URDF in ROS

Outline

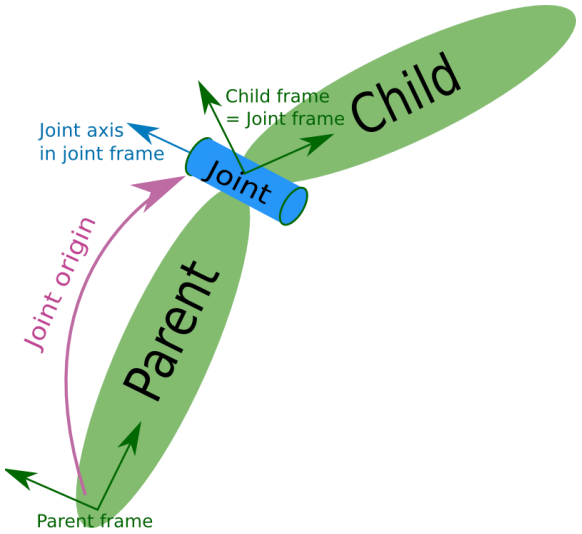
ROBOTICS CORNER

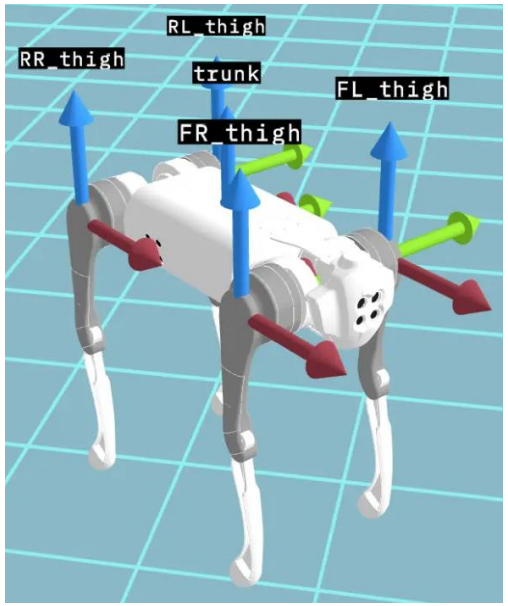


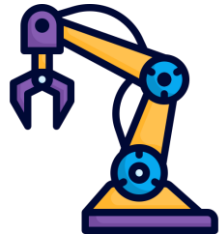
Definition

URDF, **Unified Robot Description Format** is an XML format for representing a robot model. URDF is commonly used in Robot Operating System tools such as rviz and Gazebo simulator. The model consists of links and joints motion.

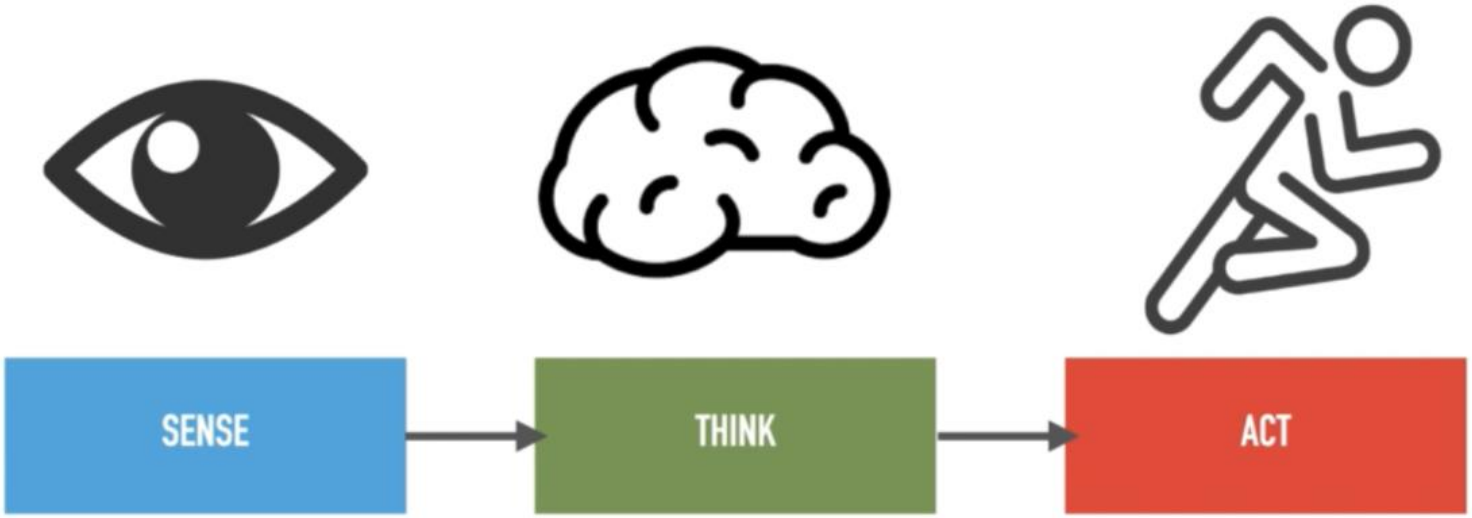
- To define a robot we have to describe all the parts(aka **links**) and connections between them (aka **joints**).

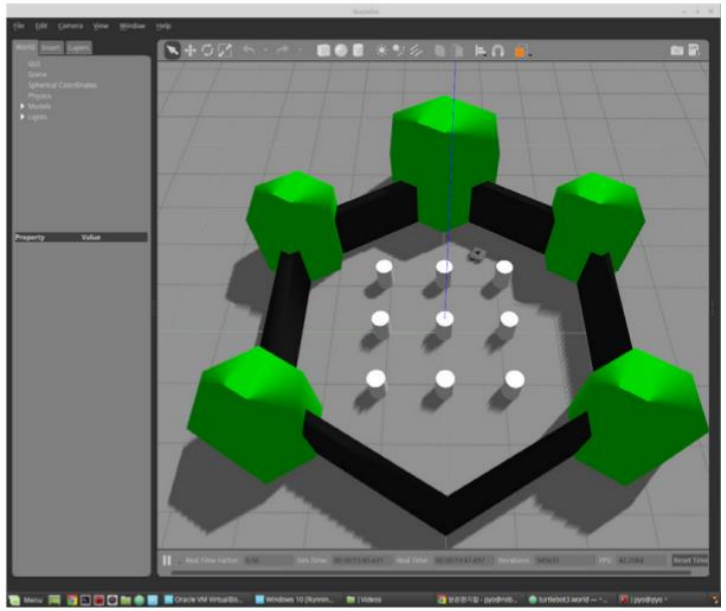


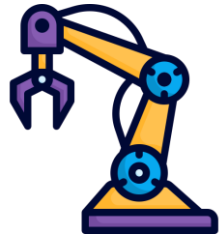




Robotics SW Cycle

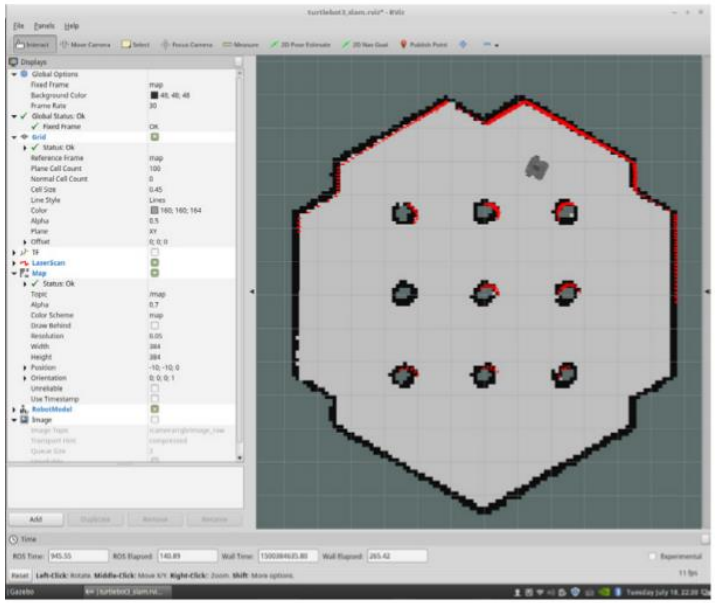




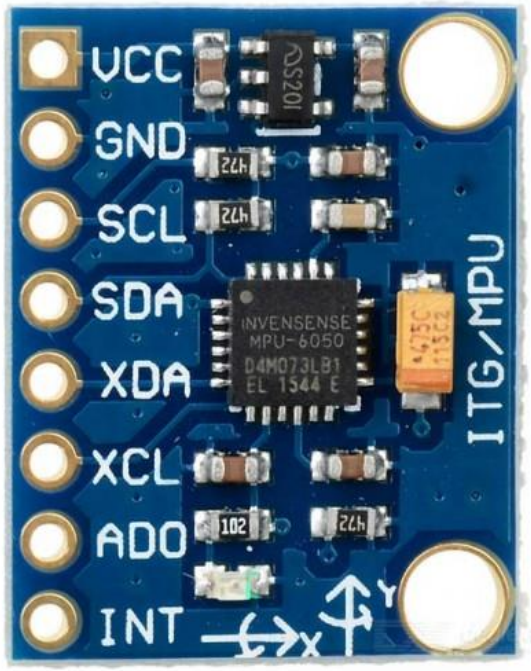


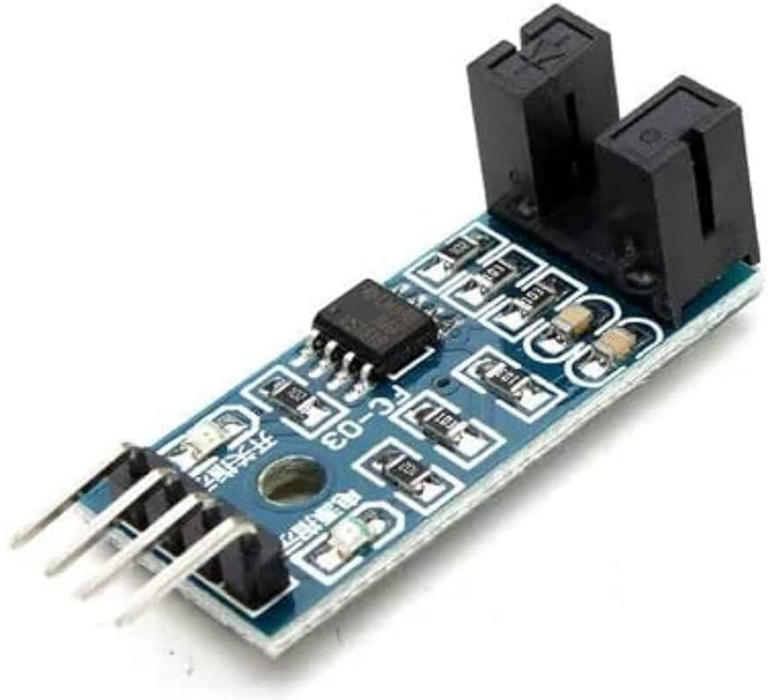
Sense - Think - Act

- To accomplish a task, a robot should “understand” the environment from its sensor measurements.
- Understanding: capturing the information at the right level of abstraction.
- An autonomously navigating robot should know
  - what the environment looks like
  - where it is in the environment
  - …



IMU, Lidar, Incremental encoder





What is Laser Range Finder?

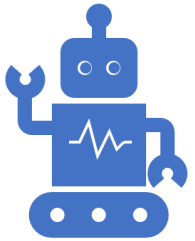
Cameras can not measure the distance (depth).

Laser range finder is based on measuring the **time of flight** between the sent and received laser beam to estimate the distance..

The laser range finder could be used in:

Obstacle avoidance.

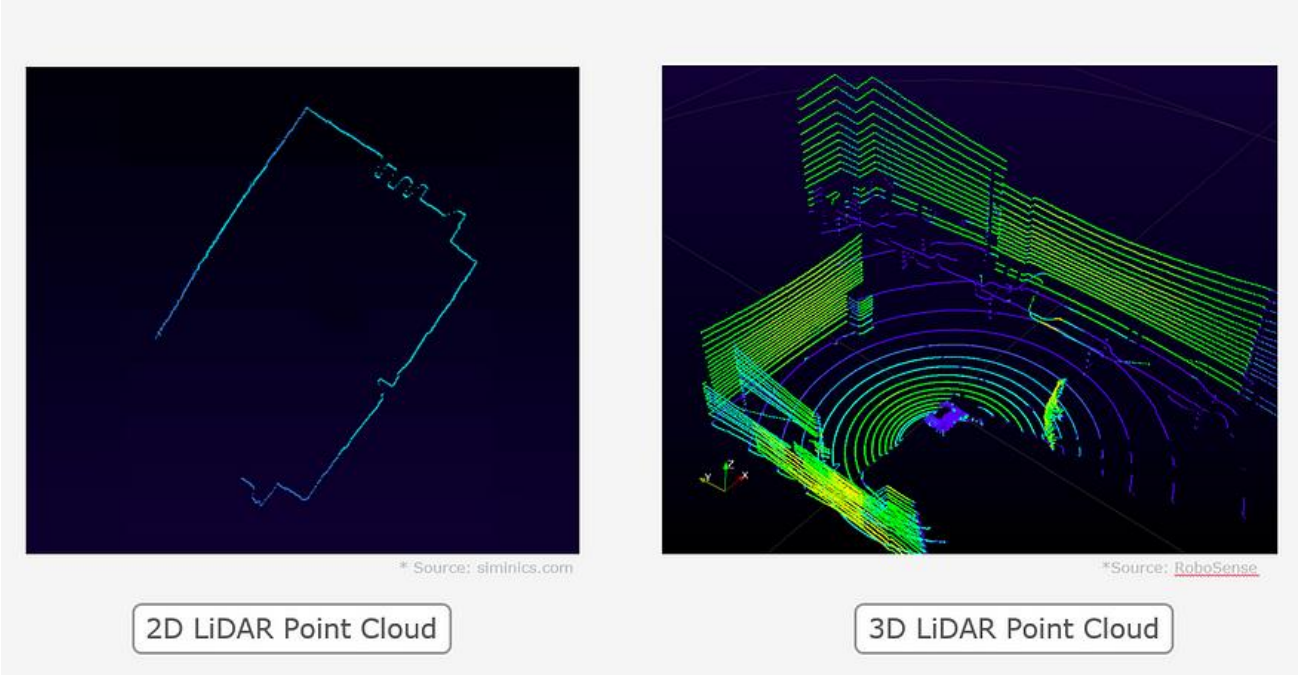
Building maps (SLAM).



Robot navigation.

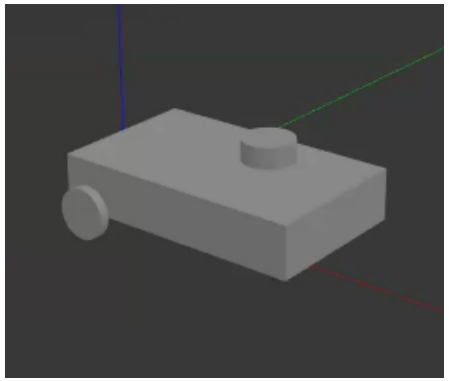
Lidar types

- There are two types of lidar: single-beam lidar and multi-beam lidar. Single beam lidar provides a 2D map of its surroundings whereas multi-beam lidar provides a 3D map of its surroundings.



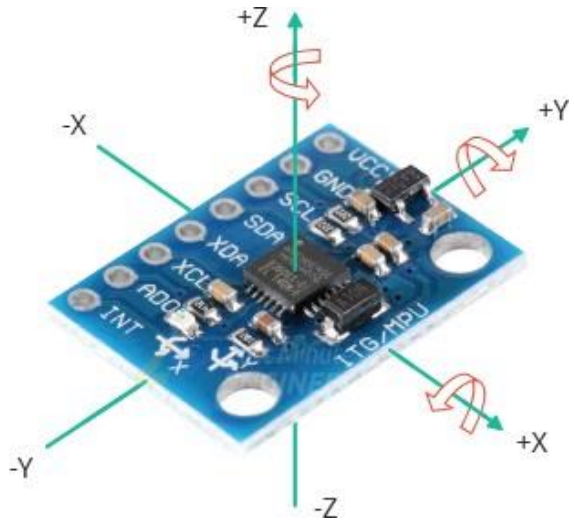
Lidar plugin in urdf

- To put the lidar plugin you should have a cylindrical link for the lidar and a joint connecting it to the body.
- The gazebo lidar plugin is added at the end of the file and references the lidar link.
- You can find the plugin in this link:
- https://github.com/husarion/rosbot_description/blob/master/src/rosbot_description/urdf/rosbot.gazebo



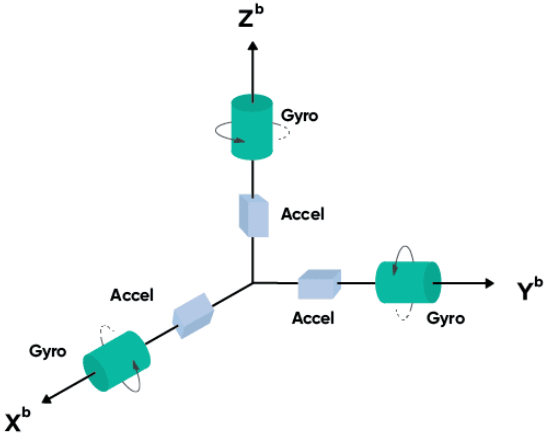
What is IMU?

- IMU (sometimes referred to as an inertial reference unit [IRU] or motion reference unit [MRU]) is typically an electromechanical or solid-state device that contains an array of sensors that can measure motion. That is, to detect linear acceleration (the rate of change in velocity) and angular rate (change in angular velocity) in about the X, Y and Z axes and provide data about that motion



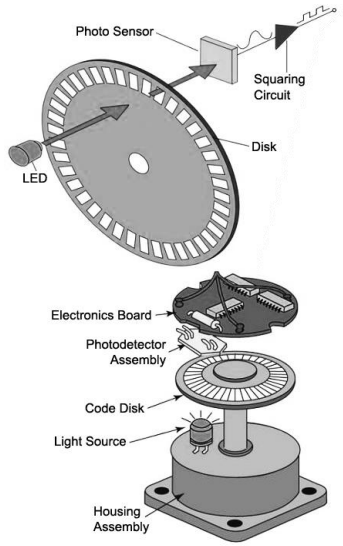
What is IMU?

- The IMU can measure motion by converting the detected inertia, which are forces created due to an object's resistance to changing direction, into output data that describes the motion of the object. This data will be used by some other system, for example, to control a vehicle. The output of an IMU is typically the raw sensor data from:
  - **Accelerometers** (linear acceleration measurements along each axis)
  - **Gyroscopes** (rotational rates/angular velocity measurements around each axis)



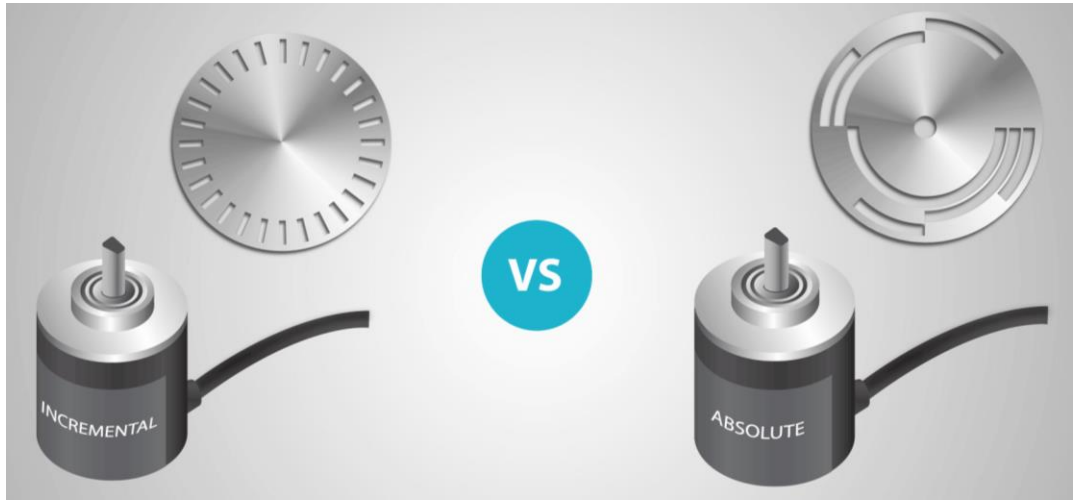
IMU plugin in gazebo

- Like the lidar, the imu plugin is put at the end of the URDF file
- There is a plugin for IMU that needs to have a link as a reference
- There is another plugin for IMU that doesn’t need to have a link as a reference
- You can find the IMU plugin here:
  - https://classic.gazebosim.org/tutorials?tut=ros_gzplugins



Types of encoder

- "**Absolute Rotary Encoders**" can measure "angular" positions while "**Incremental Rotary Encoders**" can measure things such as distance, speed, and position.
- Rotary Encoders are employed in a wide variety of application areas such as computer input devices like mice and trackballs as well as robotics.



Thank You

Do you have any questions?

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