**Comparison of SLAM using Hokuyo and LDS sensors in Gazebo**

The objective of this project is to perform slam mapping and autonomous navigation using LIDARs, the LDS and the Hokuyo 3D Lidar. The LDS Lidar is default in the gazebo environment and already has all the necessary urdf and xacro files : **turtlebot3\_burger.gazebo.xacro and turtlebot3\_burger.urdf.xacro**

The detailed slam mapping and autonomous navigation tutorial is provided by the turtlebot3 emanual website. On following the instructions given on the website , the slam map obtained from the LDS was accurate as per the given environment and was achieved in few traversal steps. Using this map, the robot was first placed in rviz and then autonomous navigation was done setting any goal in the environment. The simulation went well and can be seen in the video uploaded under the video folder.

The urdf and xacro files were created for the hokuyo sensor :

**turtlebot3\_burger\_hukoyo.gazebo.xacro and turtlebot3\_burger\_hukoyo. urdf.xacro**

On using just the horizontal beams of the hokuyo lidar, the sensor was visualized in the gazebo and the lidar rays could be visualized in rviz too. However, the sampling rate was one factor that was manipulated to check how well the lidar performs at similar sampling rate as LDS. Additionally, the horizontal beam angles and the range of the lidar were modified in the turtlebot3\_burger\_hukoyo.gazebo.xacro to check how well the lidar performs and traces it environment. Visualizing the hokuyo Lidar using both vertical and a horizontal laser scan in gazebo was possible, However , understanding the mapping of such a 3D Lidar and visualizing the point cloud map in rviz was not achieved. Multiple iterations of changing the sampling rate field of view it was still impossible to visualize the map in rviz.One possible reason for this maybe Hokuyo Lidar required computationally expensive GPU and visualizing the 3D point cloud in different viewer.

Hence to perform slam mapping in appropriately and proceed with the autonomous navigation, hokuyo lidar visualization using just horizontal beams proved to be effective and logical choice in our setting. The autonomous Navigation does not perform as well as LDS sensor, the reason behind this is that hokuyo visualization is not good enough and it keeps updating the odom pose too as turtlebot is not sure where it exactly is based on yaml file of the hokuyo map. In the autonomous navigation with the hokuyo lidar generated map, the robot was unable to move correctly and constantly flickered in one place at rviz whereas turned towards right in gazebo

The hokuyo lidar slam and autonomous navigation gave an unsatisfactory performance even after constricting the lidar to just horizontal beams, running the slam map, it was visualizing map of its surrounding however due to anomalous behavior upon running the navigation node there are certain mapping and autonomous navigation tweaks needed to make it better navigate.