Project 1: CAD Modelling and Simulation using Gazebo

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Abstract

The overall objective of the project is to Build a mobile robot model on SolidWorks and export it as URDF. And then add a LiDAR Sensor on to your robot and show the LiDAR points in RViz. After that perform teleop and move around in the map in Gazebo using a publisher subscriber code so that it moves ahead either in a straight line or in a circular loop for 10 15 seconds.

1 Build a model on Solidworks

As per the mentioned specification, We build the 3D model of the Robot. Build the individual CAD models of each part(chassis, wheel etc.) with length and breath of chassis 38 and 20 inches respectively and wheels of 8 inch diameter to mention a few. and then assemble them into a single file. Finally used the URDF exporter tool to define parent, child links of the Robot.

2 Add Controllers and Laser to your Robot

2.1 Lidar file

After converting to URDF file I exported the folder into catkin ws/src. After that I run the command for checking URDF file, there was an error which was resolved by following the command to install the dependency.

2.2 Modify URDF for extra links and joints

After that I created a dummy link with no properties specified except the name of the link and launched the model on an empty gazebo world. Then for steering it I used the Effort Controllers and for longitudinal command, I used the Velocity based interface to run the Robot.

2.3 Adding lidar files and Integrating the sensor

Then I downloaded the Lidar's URDF and DAE file from the link given in the file and place them in URDF and Meshes folder respectively. Added data related to lidar's physical properties like origin etc, and mentioned them in the xacro file, also downloaded from the given link in the doc.And later run the rosrun xacro xacro -o command to integrate all the sensors together.

2.4 Updating config file

Downloaded the config controllers.yaml file and changed my robot name with My own robot package's name. After that I changed the controller 1 name to the name of our controller, added the type of our controller, Added the name of joint as mentioned in our URDF file and finally added a PID gains set.

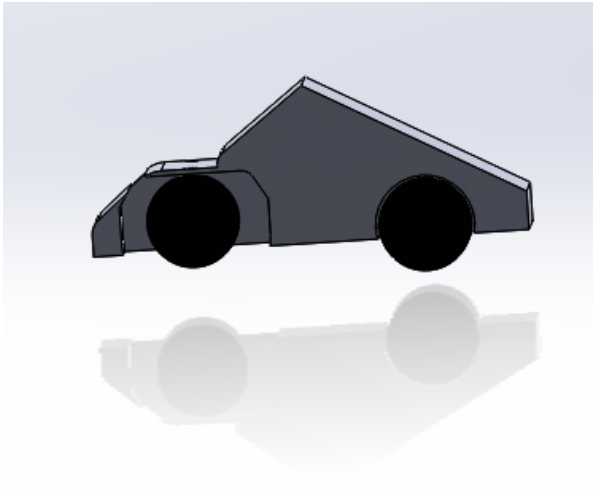

Figure 1: ROBOT model.

2.5 Launch file

After this we integrated all the sub tasks in the launch file, We then imported the robot's description as we defined earlier using the .xacro file. Most importantly added the controller names that we defined in the config folder's .yaml file. Later on rviz, we added the laser scan topic and visualised the 3D lidar point in rviz.

2.6 Running both the gazebo world and showing rviz

We successfully run the robot both in the gazebo world and the rviz

2.7 Run Teleop

Downloaded the template teleop file into a new src folder of our package and edited the publisher definition to publish onto specific topics. We used the 3 publishers for left, right steering and forward as per the given file. Using the navigation keys we moved our robot around.

2.8 Code up a simple publisher-subscriber

Then we code up a simple publisher code to drive our robot and made the robot to subscribe to that topic so that it actually follows those commands. We were able to successfully executed all the commands given in the project.

Link Video 1- https://drive.google.com/file/d/12G5jXjxlOqG5rbAnxeC3sPEw4fS83wLm/view?usp=sharing

Link Video 2- https://drive.google.com/file/d/122qkKqGHA07MOpNy-PXqTf226e6fK$_U$*E*/*view*?*usp* = *sharing*