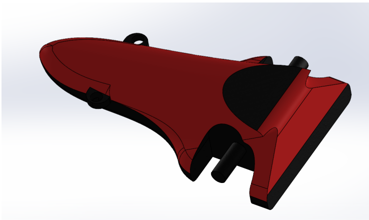
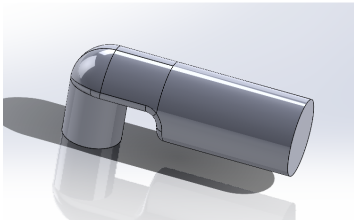
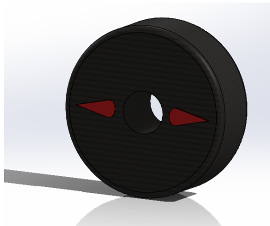
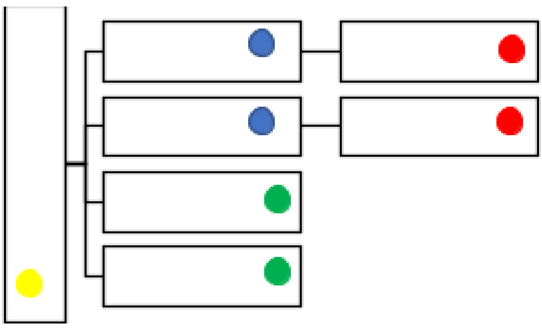
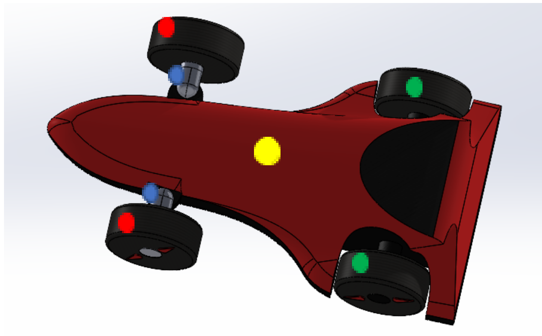
Project 1 Report
ENPM 662 - Introduction to Robot Modelling

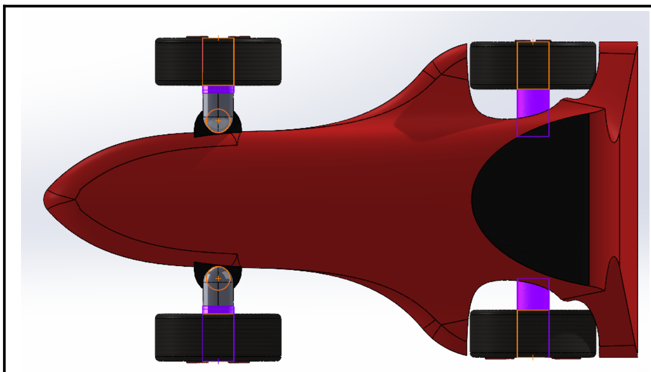
CAD Modelling

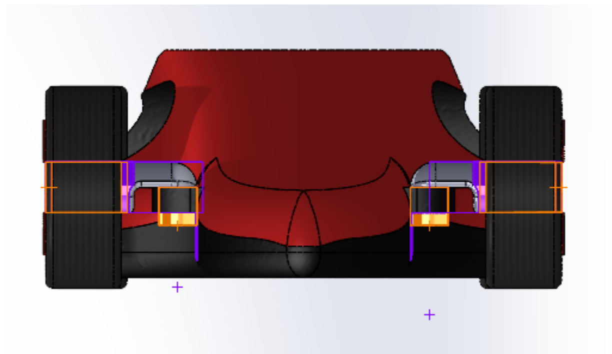
Car Body	Stub Axle	Wheel
		
The basic structure of the car, with axles for rear wheels and pivot joints for front stub axles	Connects the wheels to the car and provides joints for rotation and steering	Makes the car move due to its rotation, driven on the rear axle and free on the front
Made using 'Loft' between 2 planes; multiple 'Cut/Boss' Extrudes on LH followed by mirror around centre	Two 'Extrudes' on intersecting planes and 'Fillet' to round all corners	Simple circular sketch with 'Extrude' and 'Cut' in the centre





The assembly had concentric mates to align the rotational components to their axis of rotation, and coincident joints to make sure there is no displacement along the joint direction



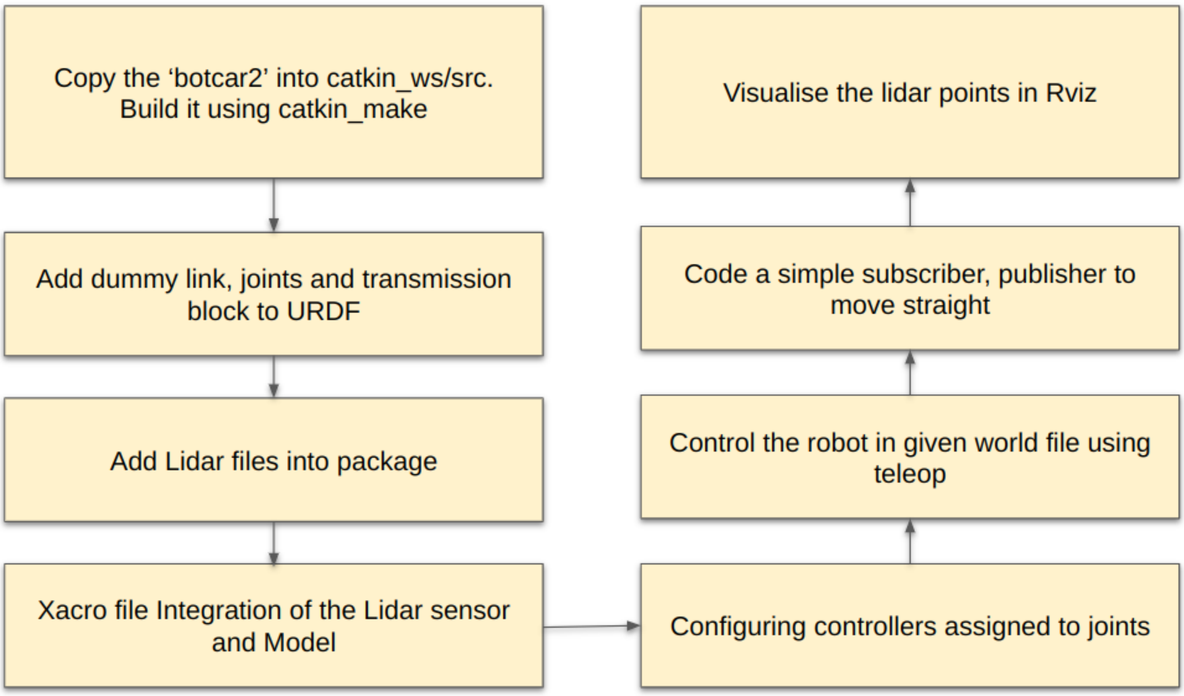


We start the CAD model by conceptualizing a car, how we want to make it. Finally, a small toy car was chosen as the target design. The entire assembly is divided into 7 links, which are made out of 3 unique parts respecting the given dimensions, material and mass:

Then the entire assembly was exported as ‘botcar2’ using the URDF exporter along with the meshes. Wheel joints were set continuous, and steering joints set as revolute (range -3.14 to +3.14 radians) and we then jumped into ROS with the package

ROS

The process to create and execute the package was as follows:



Problems Faced

1. We got errors related to the controllers not present, so we installed them using the command given in the instructions. But still we had the same error, so we used a general command to install all ROS Noetic Controllers (sudo apt-get install ros-noetic*control*) hoping this will get what we need.
2. Lidar is positioned inside the car and the default launch position of the robot in Gazebo is inside the ground. To fix that we changed the frame transformation of the carbody_base_link and added a roll of 90 degrees to fix the spawn orientation and a small 0.1 displacement to make it spawn on top of the floor.
3. We were unable to make the car move using teleop. A quick check of the URDF revealed that our mass was too high, and we went back to SolidWorks to choose a lighter material and cut a slot under the car to reduce material further.

Links:

Teleop Control with Lidar Visualization: Robot Car keyboard control in ROS

Subscriber and publisher nodes: Subscriber and Publisher node for ROS Controllers

Fig. 1: URDF Layout

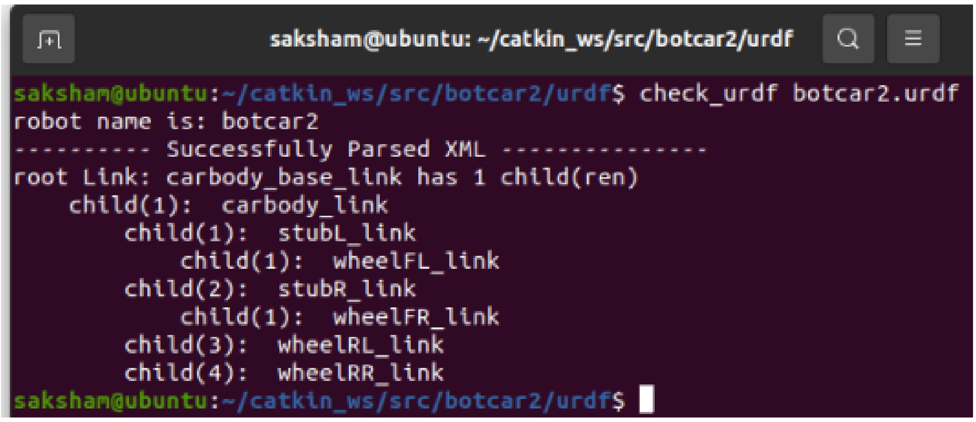
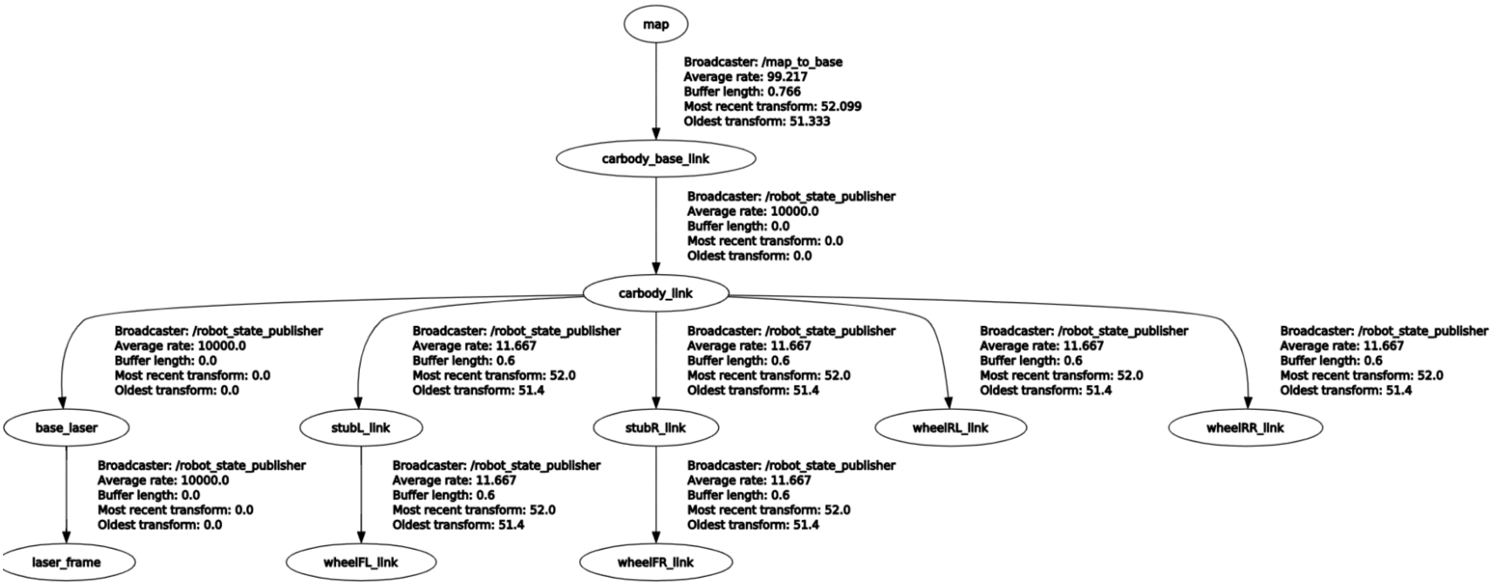


Fig. 2: TF Tree



Note: All project partners contributed to all aspects of the project. I worked specifically on launch files, importing the world, adding controllers, making subscriber and publisher.