Project Report

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INTRODUCTION

Designed a robot on SolidWorks with 4 wheels, Integrate a Lidar sensor, write a python code on teleop to control the robot in gazebo, write a python code for publisher and subscriber to move the robot for 10-15 seconds either in a circle.

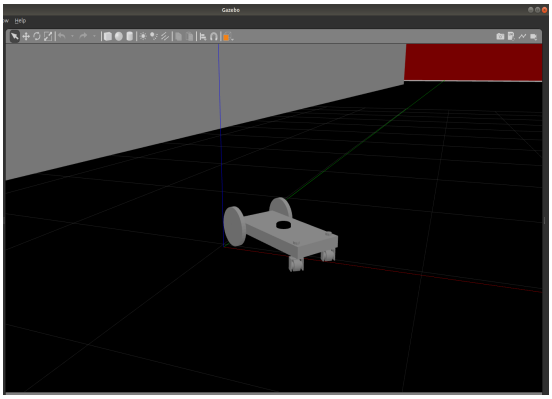
METHODOLOGY

Design a 4 wheeled robot on solid works with the constraints:-

Max Length: 38 inches	Max Width: 20 inches	Wheel Base: 20 inches
Max Wheel Thickness: 3 inches	Max Wheel Diameter: 8 inches	

To keep in mind that the front wheels of the robot should be made steerable separately as you cannot have a .urdf file with a child that has two parents. Our robot is designed with the rear axle to be driving which has two wheels as it's children, and the two front wheels as independent joints which can be used to steer the robot. We exported this project as a urdf file, while doing so we have to make sure all movable joints are defined as continuous joints and make sure of the axis.

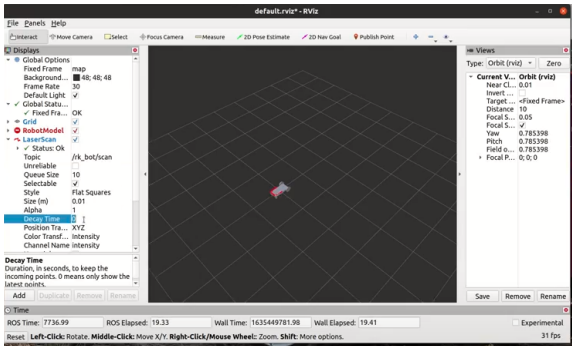
Import this urdf file into the gazebo world to see if all the parts are intact and in correct orientation. Then create a dummy link and a dummy joint with the child as the base link of the robot and parent as the dummy link in the urdf file of the robot. Post this, we have to include the transmission blocks into the urdf file, we should have one transmission block for each movable joint. The transmission block type for the steerable joints should be Effort Joints and for driving wheels should be Velocity Joints.



We can add the lidar to the robot by downloading the urdf file and DAE for the lidar and place them in the URDF and Meshes folders respectively. In the urdf file of the lidar, we should paste the code snippet for the ylidar in the lidar.urdf file, we should also create a joint in between the lidar and robot. To merge these two urdf files, we should download the .xacro file template and give the paths for the robot's and lidar's urdf file in respective places. Check to see if the xacro file is working well by generating a urdf file from the xacro file and using urdf check.

We should define controllers for the robot by downloading the config_controller.yaml file and in the file we should define one controller for each of the transmission joints. Make sure that the controller type for the Velocity Joint is a Velocity Controller and the controller type for the Effort Joint is an Effort Controller. Name the controllers respectively and tune the PID parameters for efficient running.

To integrate all the above files, we should define a launch file. For this, download the template of the launch file and the world file. We have to add the controllers in this launch file. After this we should build the files and import it in gazebo to check for errors.



To visualize the lidar, Import the robot model to the rviz environment, add a laser sensor to the model, and give the respective topic. If everything is successful, we can see a red laser coming out of the lidar.

To control the robot with teleop. We should download the teleop template file in python and add the controllers that we defined in the config_controllers.yaml file in the publisher block at respective places. To check this step we should rebuild all the files, run gazebo parallely with Teleop, and control the robot using a keyboard and see that the robot is moving as expected.

Next we have to make a publisher subscriber code to make the robot move in a circle for 15 seconds, download the template and code in the python file to send the commands to the Robot. We first have to turn the steering wheels and give them acceleration to the driving wheels for the robot to go in a circle.

To check if everything is working, we should run Gazebo, Teleop and RViz parallely and add the robot into the RVIz environment and define the laser sensor and it's topic. Then using teleop we should navigate the robot from the origin to the finish line, and record the screen. For the second video, we should run Gazebo and the Publisher Subscriber python file and record the screen of the robot performing the action on the Gazebo window.

DELIVERABLES

We have included the files to be placed in catkin_ws folder and the assembly and parts folders generated through solid works. And a Readme.txt file on how to build and run the robot.

The Video Links are:
Video 1: Click here to view the video of mobilebot moving with the lidar sensor in the environment from start to finish.
Video 2: Click here to see the mobile bot movement with custom coded publisher and subscriber.

CONTRIBUTORS

Koundinya Vinnakota (118239811)
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Koundinya worked majorly on designing the robot, integrating the lidar and modified urdf files and xacro file. Rishabh worked majorly on Publisher and Subscriber and Teleop.