ENPM 662 Introduction to Robot Modelling
Project 1 : CAD Modelling & Simulation using Gazebo
ReFineBot

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Report :-

1. Cad Modelling:
   - We mutually agreed on modelling a differential drive robot. However, the model underwent numerous iterations and design changes as every exported model was facing axis mismatch and other issues. In the end, we settled on a differential drive with four independent wheels and a chassis.
   - Chassis Dimensions:-
     - ☐ Length - 38in
     - ☐ Breadth - 20in
     - ☐ Height - 4in
     - ☐ Bore Diameter - 3in
     - ☐ Bore Length - 5in
   - Wheel Dimensions:-
     - ☐ Wheel Diameter - 8in
     - ☐ Wheel Thickness - 3in
     - ☐ Shaft Diameter - 3in
     - ☐ Shaft Length - 5.5in
   - All the wheels are independent and were bound by 2 mates in Solidworks
     - ☐ Concentric Mate between shaft and chassis bore
     - ☐ Distance Mate(0.5in) between the outer face of the chassis and inner face of wheel
   - The URDF file has the base link as the chassis and 4 child links as the four independent wheels as continuous joints which is ideal for differential drive.
   - Problems faced :
     - ☐ Making the SW models orientation similar to Gazebo's axis.
     - ☐ Setting up reference axes and planes for every part was something that we missed out on and hence caused the majority of the problems in all our models.
     - ☐ Other errors due to disorientation in the axes caused multiple spawning errors in Gazebo.

2. Simulation Using Gazebo:

- Nomenclature was a little confusing as we had multiple packages(namely refinebot, finebot, newbot, toycar, mycar, steerbot, and many more).
- The orientation of the Lidar had to be tuned in manually.
- While spawning the bot in the competition world, the bot was behaving erratically which was solved by making a new model itself.
- There was also an error encountered where it was not reading the controllers.
- We used 4 controllers which were calibrated 4 independent wheels with equal velocity. Initially, we tried working with revolute joints and assigning effort controllers to it and that also did not work for us irrespective of the limits given for the joints. However, we switched over to velocity controllers which later resolved the issue.
- We were also asked to tune the PID values manually however there was an error encountered stating " No p gains specified".
- There was a constant spawn error which we were asked to ignore.
- The teleop template was pretty vague in our case considering that we have low knowledge in coding and the template would have been far more beneficial for someone with steering control. So we had to write the teleop file from scratch and which took a lot of time because most of the functions were not making any sense to us given in the template file.
- Also, there were times when the naming between the files clashed with each other and were really hard to debug.
- For the publisher, the regular publisher command was not working in our case from the template file, we had to try different variations since our case was differential drive.
- There was an error in visualizing the bot in rviz as one of our systems was not able to open one of the part .stl files, this was resolved by exporting the urdf and going through the whole process again.

Unfortunately, because of the numerous errors we faced, both the members had to go through all the steps individually multiple times. So we did not have the luxury to distribute the work.

We definitely feel that we should have spent more time on this project, understanding how each component of the process works. We apologize for the errors caused and would like to thank the TAs and the professor for all the help and knowledge imparted to us that enabled us to complete the project.