Section 1 : Robot Design

Sunday, 5 September 2021 1:49 PM

S#1 :: Course Walk through

Tuesday, October 19, 2021 7:22 AM

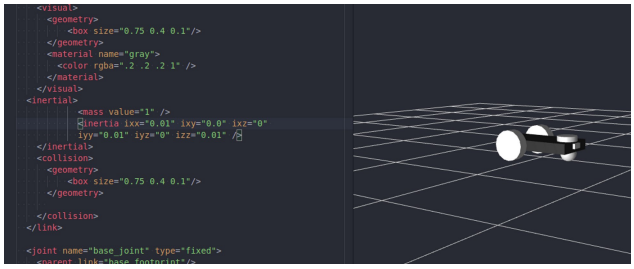
Robotics Project Workflow in ROS

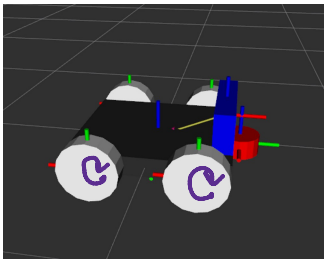
URDF

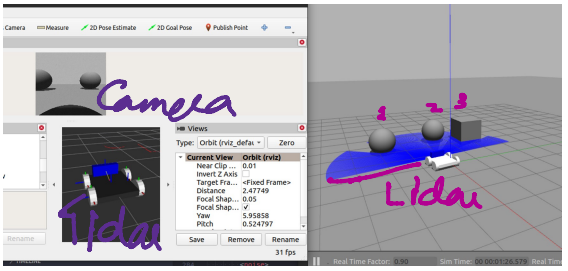
Joints axis test

Plugins addition

Simulation set







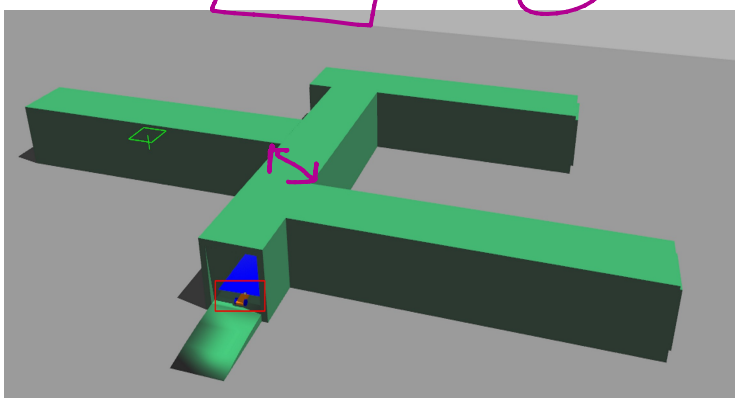
RVIZ Gazebo

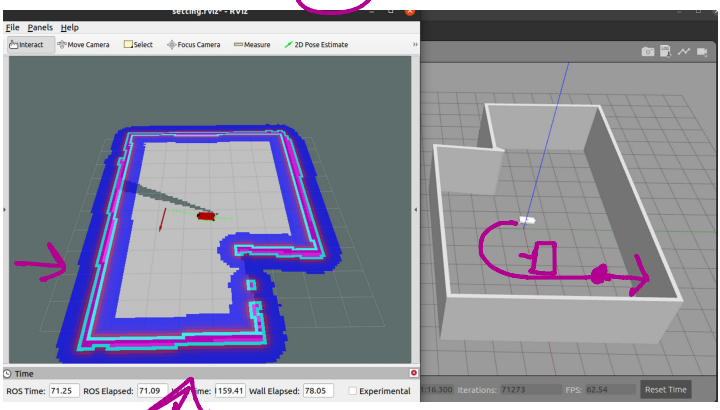
Map

1

Project Completion

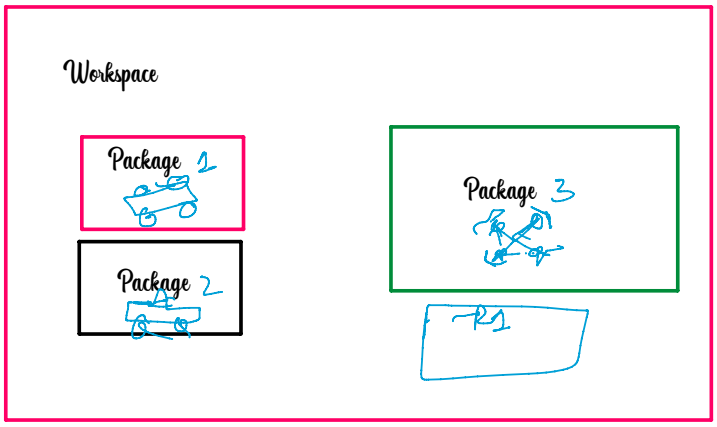
2

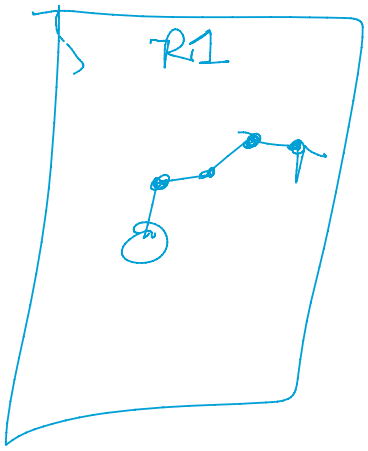




S#1 :: Work-Space and Custom Package

Monday, July 5, 2021 2:38 PM





Custom Workspace and Package

Workspace

- Single / Multiple Workspaces

Python Package

- Create with dependencies (rospy , std_msgs)

S#1 :: Custom Robot Design through URDF

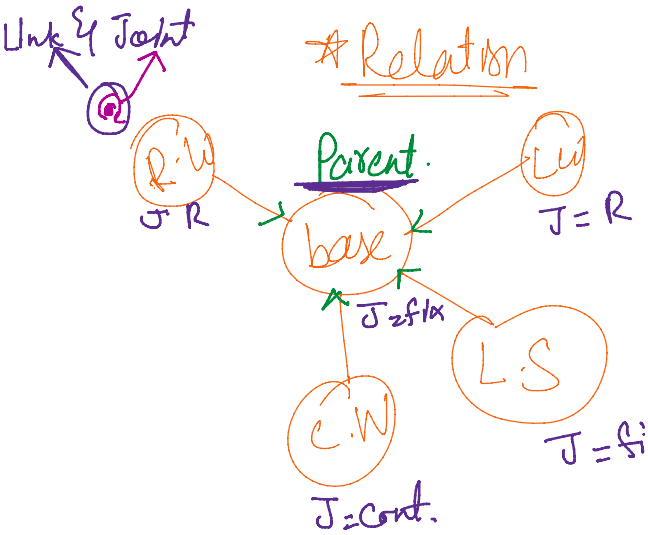
Tuesday, 21 September 2021 10:47 AM

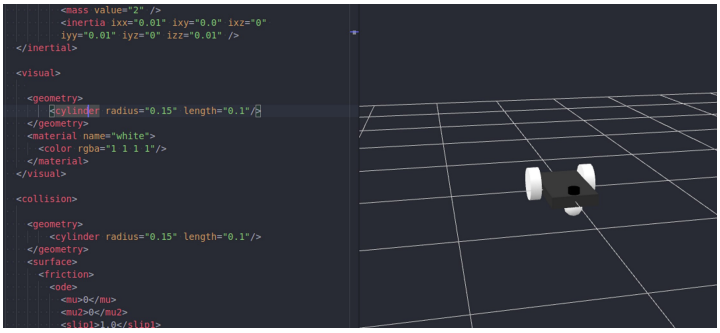
Questions ?

- Type : Mobile Robot
- Joint Types : Revolute
- Links Lengths :
- Total footprint
- Structure

① geometry: ○ □
② PhysicalProp: collision : Inertia
③ Color: white

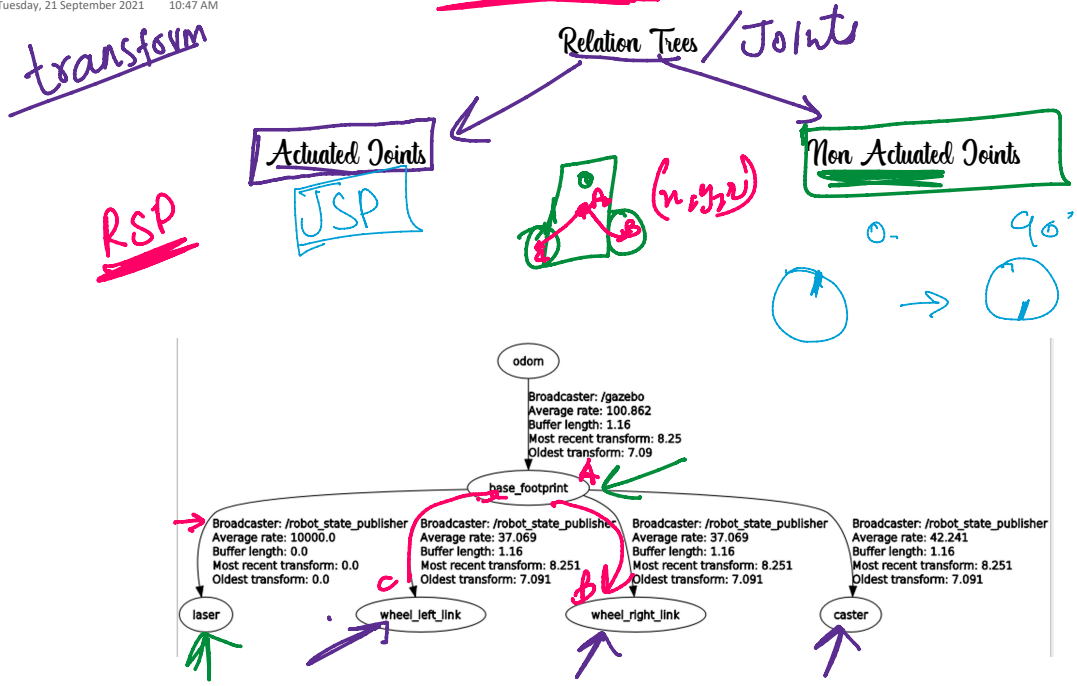
Joints.
- Revo 180 -180
- Continuous
- Prs





S#1 :: TF States publishing using RSP & JSP

Tuesday, 21 September 2021 10:47 AM



rosrun rqt_tf_tree rqt_tf_tree

Section 2: Gazebo Parameter Tuning and Plugins

Sunday, 5 September 2021 1:50 PM

S#2 :: Inertia and Collision Failures

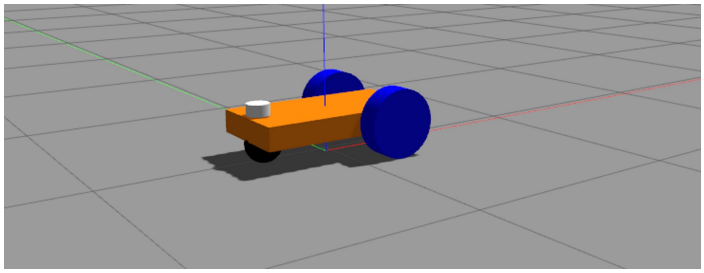
Tuesday, 21 September 2021 10:48 AM

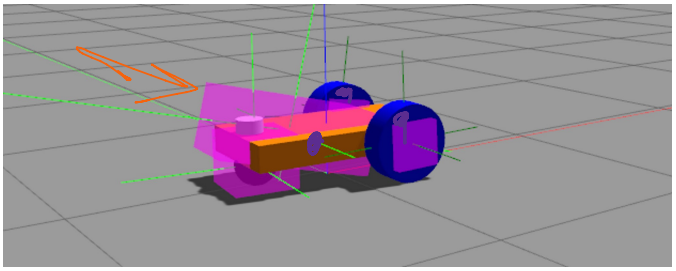
- Gazebo <--> ROS
- Spawning a model process
  - Empty World
  - Robot Description
  - Physical Properties of Links
- Forces action on Robot

robot → sp.
JSP/RSP

launch
1. Gazebo ON on
2. URdf → "robot description"
3. spawn → Gazebo
4. Inertia

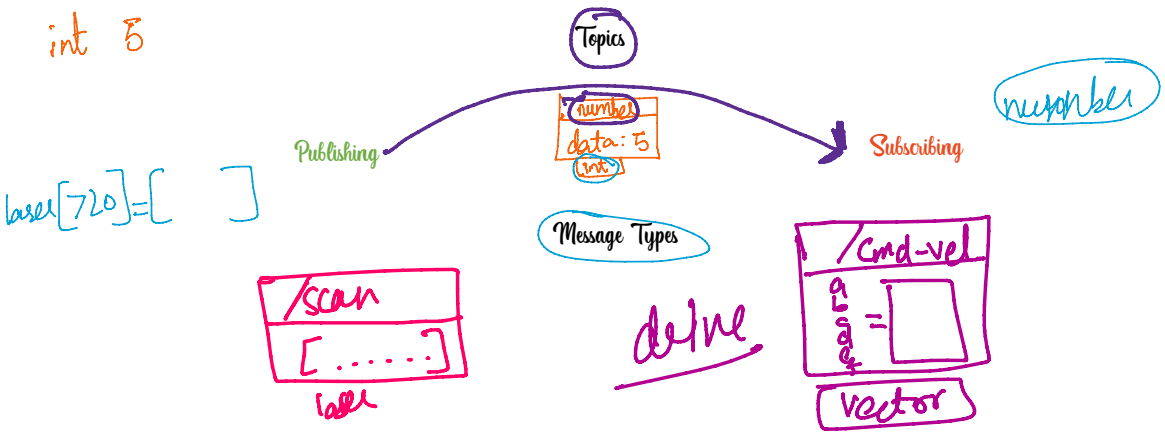
gazebo



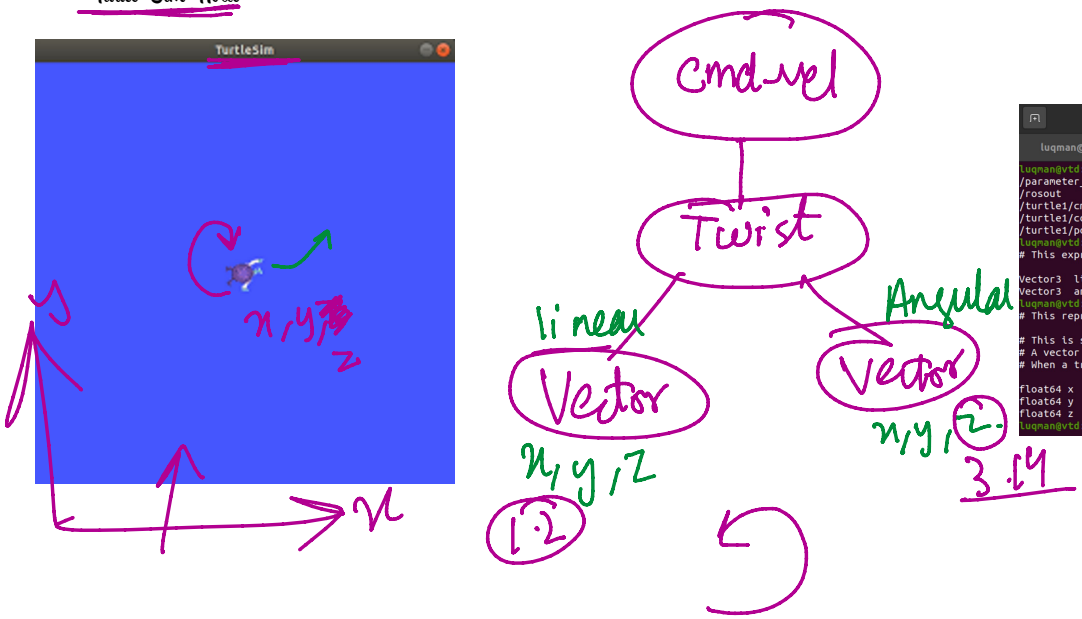


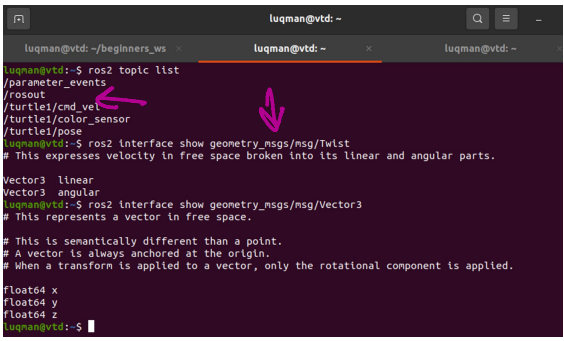
S#2 :: Publisher and Subscriber Nodes

Monday, July 5, 2021 3:22 PM



- Turtle-Sim Node





Basic Subscriber

Basic Publisher

ROS

- Message type
- Topic Name
- Frequency
- Callback Function

1, 2, 0

S#2 :: Gazebo Plugin

Monday, October 18, 2021 10:19 PM

Lidar (2)

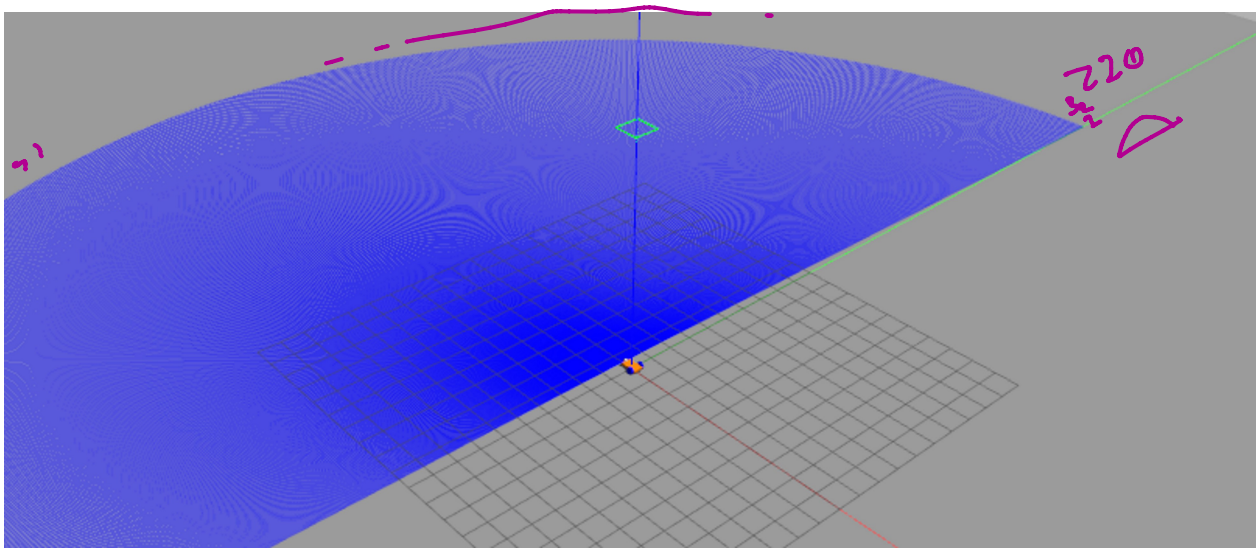
```
<gazebo reference="laser">
  <sensor type="gpu_ray" name="laser">
      <pose>0 0 0 0 0 0</pose>
      <visualize>false</visualize>
      <update_rate>40</update_rate>
      <ray>
          <scan>
              <horizontal>
                  <samples>720</samples>
                  <resolution>1</resolution>
                  <min_angle>-1.578</min_angle>
                  <max_angle>1.578</max_angle>
              </horizontal>
          </scan>
          <range>
              <min>0.1</min>
              <max>30</max>
              <resolution>0.1</resolution>
          </range>
      </ray>
      <plugin name="gpu_laser" filename="libgazebo_ros_gpu_laser.so">
          <topicName>/scan</topicName>
          <frameName>laser</frameName>
      </plugin>
  </sensor>
</gazebo>
```

(1) Differential Drive

name

```
<gazebo>
  <plugin name="differential_drive_controller"
          filename="libgazebo_ros_diff_drive.so">
      <leftJoint>wheel_left_joint</leftJoint>
      <rightJoint>wheel_right_joint</rightJoint>
      <legacyMode>false</legacyMode>

      <robotbase_footprintFrame>base_footprint_link</robotbase_footprintFrame>
      <wheelSeparation>0.25</wheelSeparation>
      <wheelDiameter>0.07</wheelDiameter>
      <publishWheelJointState>true</publishWheelJointState>
  </plugin>
</gazebo>
 <gazebo>
  <plugin name="joint_state_publisher"
          filename="libgazebo_ros_joint_state_publisher.so">
      <jointName>caster_joint</jointName>
  </plugin>
</gazebo>
```

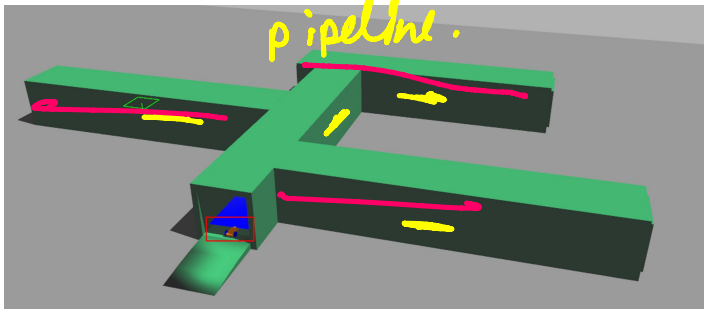


Section 3 : Pipe Line Exploring Robot

Sunday, 5 September 2021 1:50 PM

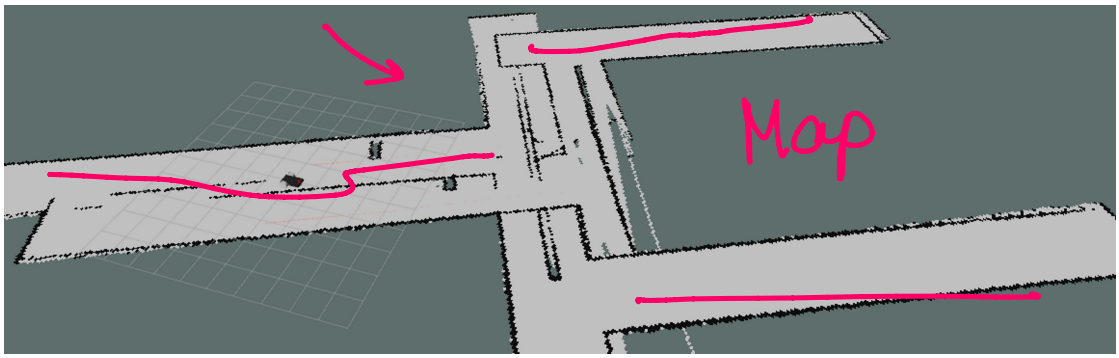
S#3 :: Project Explanation

Thursday, October 21, 2021 11:27 AM



Task Understanding

- Pipe line Issue
- Congested space , not possible for humans to go inside
- Need to Find the Location of the Issue



S#3 :: G mapping Slam

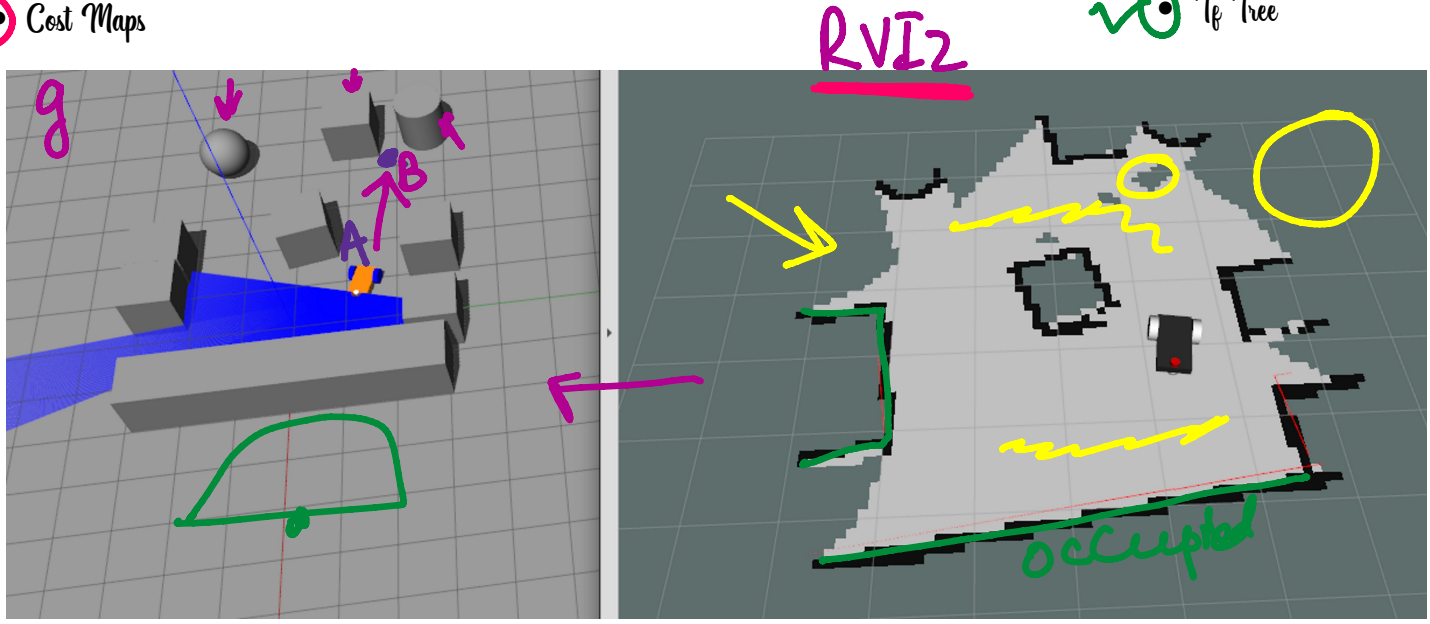
Sunday, 5 September 2021 1:43 PM

Open Slam G-mapping

- Simultaneous Localization and Mapping
- Occupancy Grid Map
- Cost Maps

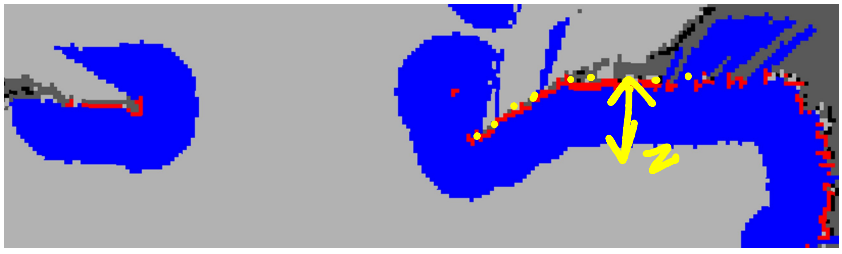
Requirements :

- Diff drive
- Odometery Data
- Horizontal Lidar
- Tf Tree

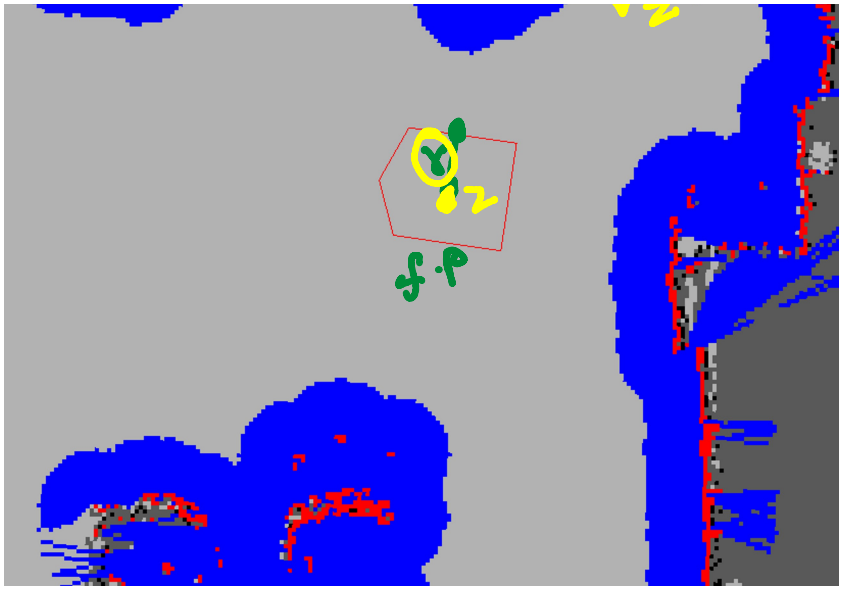


Cost Maps

- Red cells represent obstacles in the cost map.
- Blue cells represent obstacles inflated by the inscribed radius of the robot.
- Red polygon represents the footprint of the robot.



For the robot to avoid collision, the



https://wiki.ros.org/costmap_2d

For the robot to avoid collision, the footprint of the robot should never intersect a red cell and the center point of the robot should never cross a blue cell.

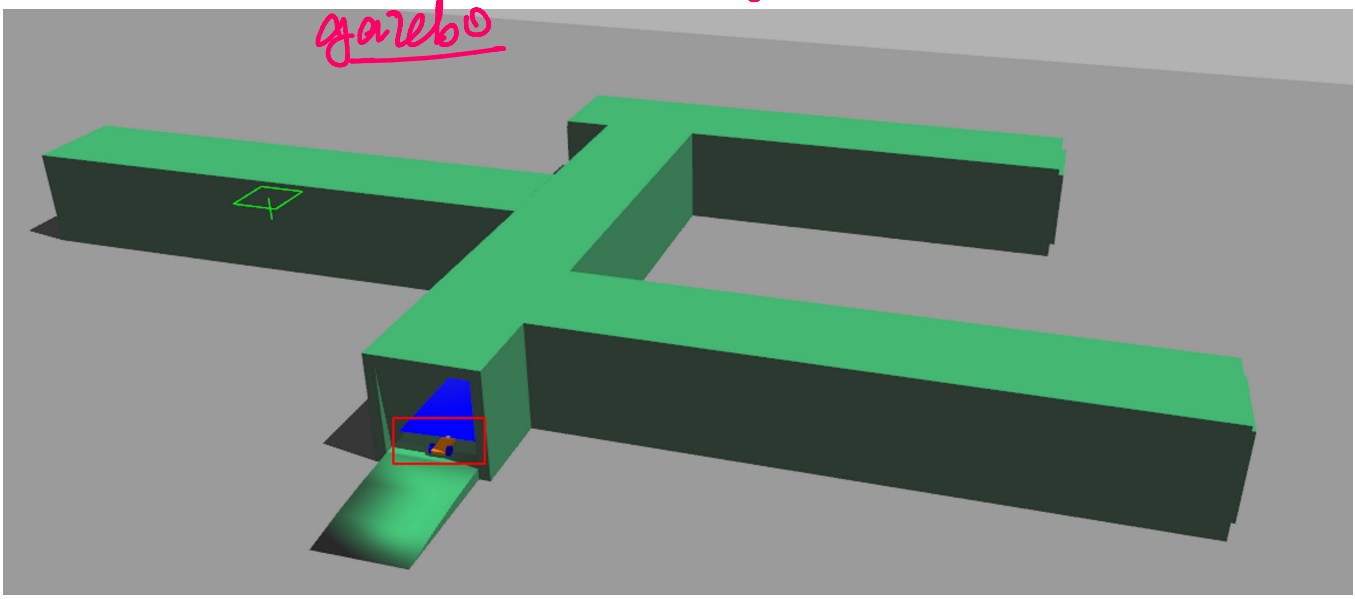
S#3 :: Model Builder in Gazebo

Saturday, August 28, 2021 10:46 AM

- Design CAD
- Meshes File , stl, dae, obj.
- Gazebo Importing

fusion 360

gazebo



S#4 :: Room Slam and Autonomous Driving

Tuesday, October 19, 2021 7:14 AM

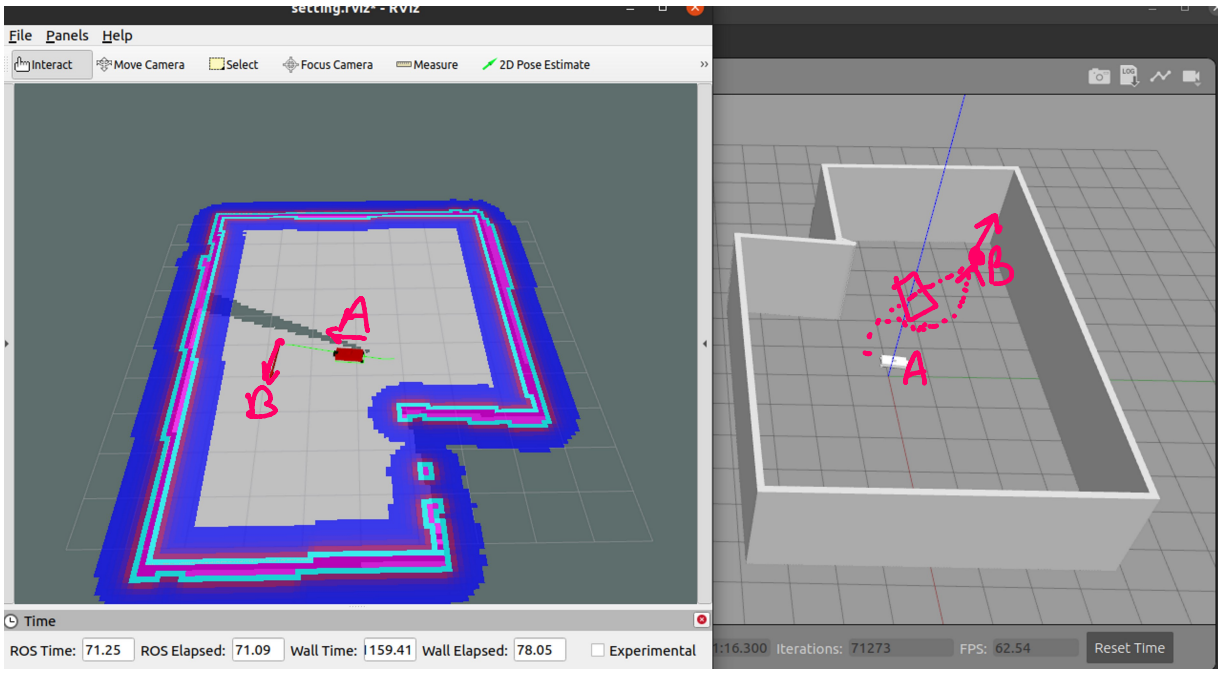
S#4 :: Project Explanation

Thursday, October 21, 2021 11:27 AM

position (x, y, z)
orientation (x, w, y)

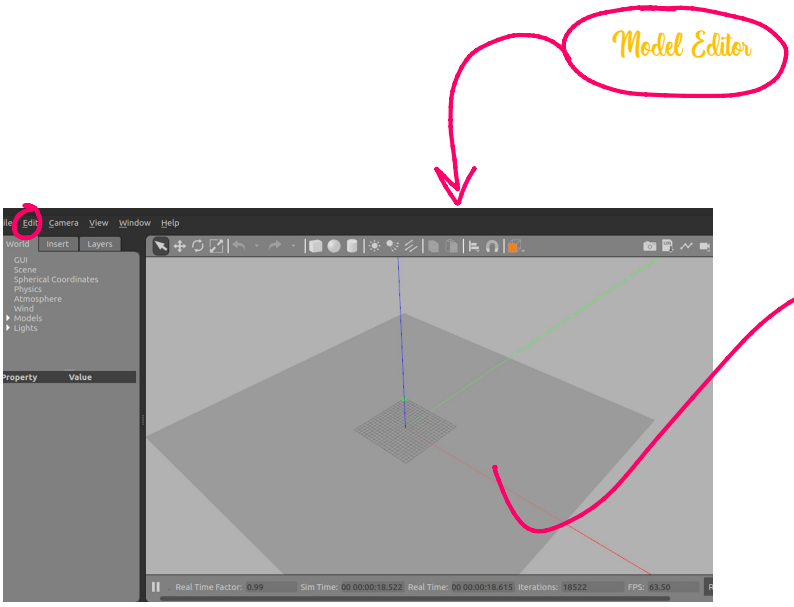
Task Understanding

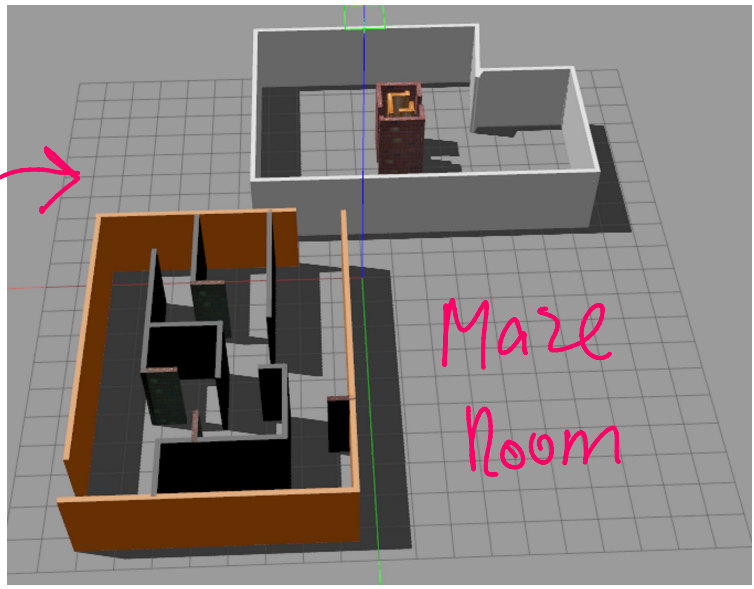
- Map of the Room
- Autonomous Driving and Obstacle Avoiding
- Point A to Point B Pose Obtaining



S#4 :: Model Builder in Gazebo

Saturday, August 28, 2021 10:46 AM





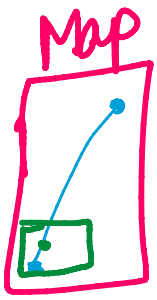
S#4 :: Navigation Stack

Monday, September 6, 2021 4:00 AM

Move-base Node

The move_base package provides an implementation that,

- Given a goal in the world, will attempt to reach it with a mobile base.
- The move_base node, to accomplish its global navigation task, links together
  - Global planner
  - Local planner



Requirements

It takes in information

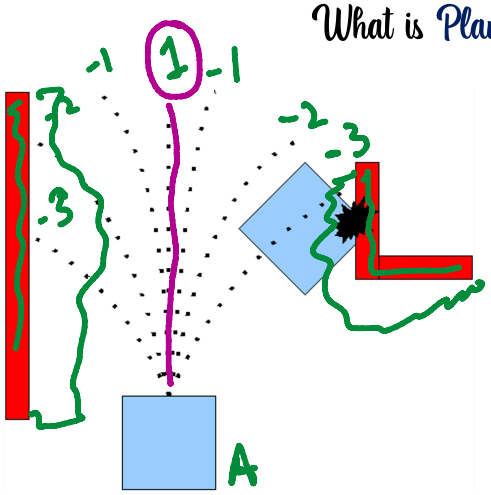
- Odometry
- Sensor streams (Lidar , IMU ,Barometer) .

Outputs

Velocity commands to send to a mobile base

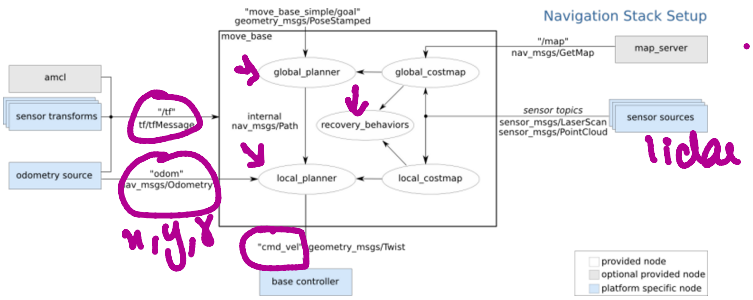
B

What is Planning?



1. Discretely sample in the robot's control space (dx,dy,dtheta)
2. For each sampled velocity, perform forward simulation from the robot's current state to predict what would happen if the sampled velocity were applied for some (short) period of time.
3. Evaluate (score) each trajectory resulting from the forward simulation, using a metric that incorporates characteristics such as: proximity to obstacles, proximity to the goal, proximity to the global path, and speed. Discard illegal trajectories (those that collide with obstacles).
4. Pick the highest-scoring trajectory and send the associated velocity to the mobile base.
5. Rinse and repeat.

Nav Core

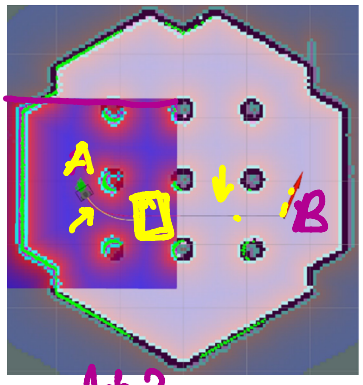


lidar

imu

DWA

https://emanual.robotis.com/docs/en/platform/turtlebot3/navigation/



tb3

Video Names

Thursday, October 21, 2021 10:02 AM

- s1_1_t_s_course_walkthroguh
- s1_2_t_s_Workspace_package_creation
- s1_3_p_s_workspace-package_creation
- s1_4_t_s_Urdf_concept_creation
- s1_5_p_s_Urdf_creationA
- s1_6_p_s_Urdf_creationB
- s1_7_t_s_transforms_jsp_rsp
- s1_8_p_s_Rviz_launchfile_RSP
- s1_9_p_s_JSP_RVIZ

- S2_1_t_s_Gazebo_ros_spawning
- S2_2A_p_s_Gazebo_ros_spawning_Inertiacalc
- S2_2B_p_s_Gazebo_colors_explore_properties
- S2_3_t_s_Nodes_cmd_vel_turtleSim (delete Publisher Subscriber Explanation at end)
- S2_4_p_s_Nodes_cmd_vel_turtleSim
- S2_5_t_s_Gazebo_plugins
- S2_6_P_s_Differential_Drive_plugin
- S2_7_P_s_Lidar Plugin
  - S3_1_t_s_PieplineProject Explanation
  - S3_2_t_s_Gmapping_Slam
  - S3_3_p_s_Gmaping_integerate
  - S3_4_t_s_intro_gazebo_stlMeshes

- S3_5_p_s_PipeLine GazeboIssue
- S3_6_p_s_Map Completion

- S4_1_t_s_NavigationProject Explanation
- S4_2_t_s_Room_model_creation
- S4_3_p_s_GazeboRoom_model_creation
- S4_4_t_s_NavigationStack
- S4_5_p_s_NavigationStack_implement