Navigation

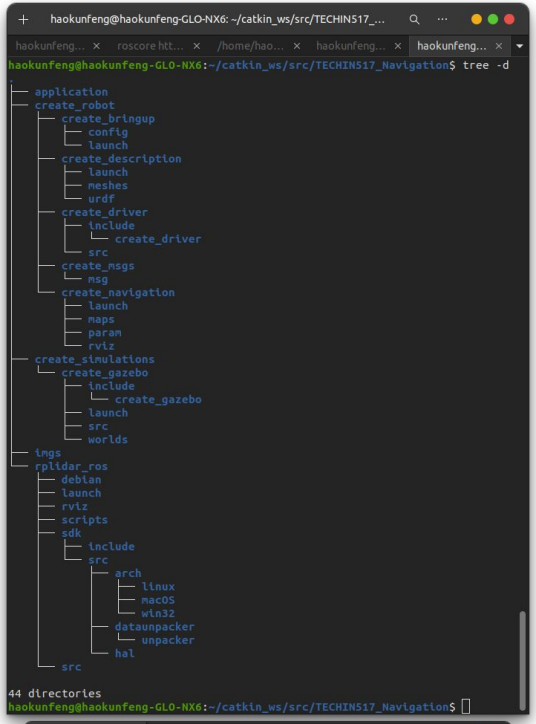
Milestone 2

05/02/24

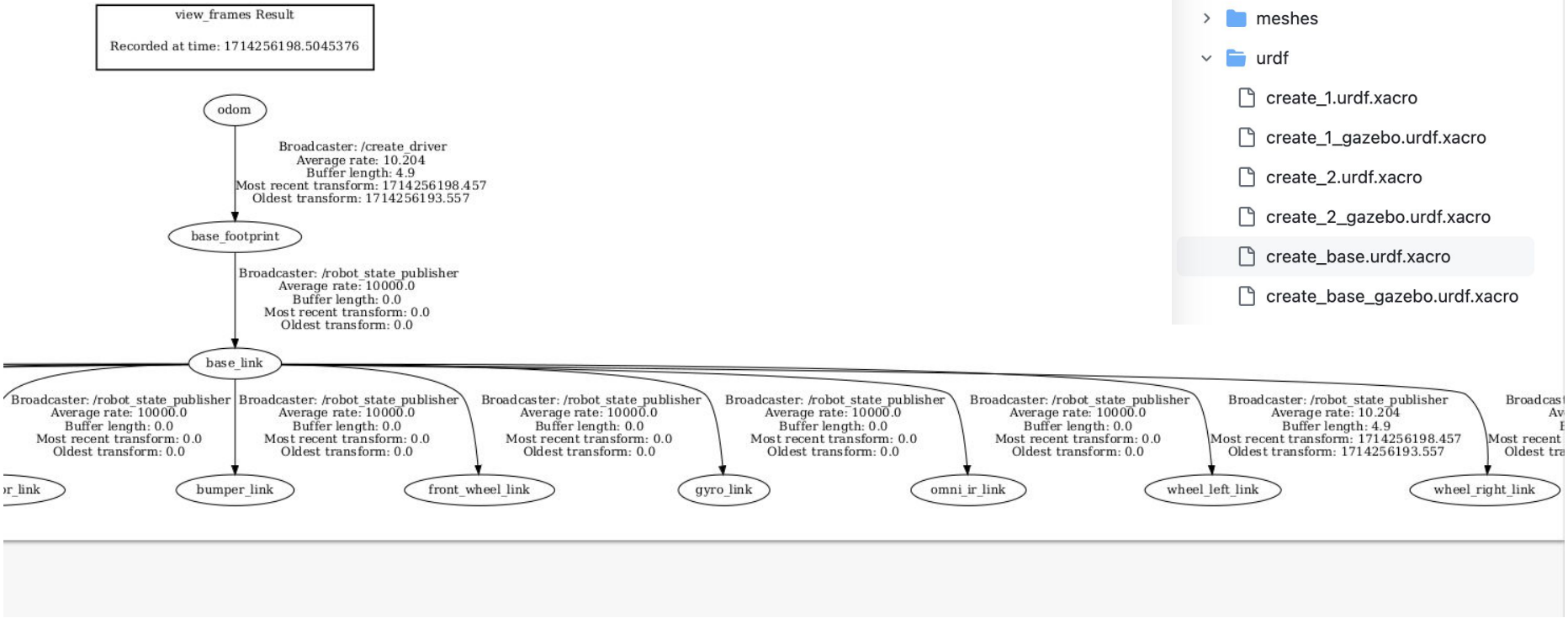
SW Architecture: Implemente package for Create2 and Lidar for navigation

- create_robot
  - create_bringup
  - create_description
  - create_driver
  - create_msgs
  - create_navigation
  - .travis.yml
  - LICENSE
  - README.md
- imgs
- map
- rplidar_ros

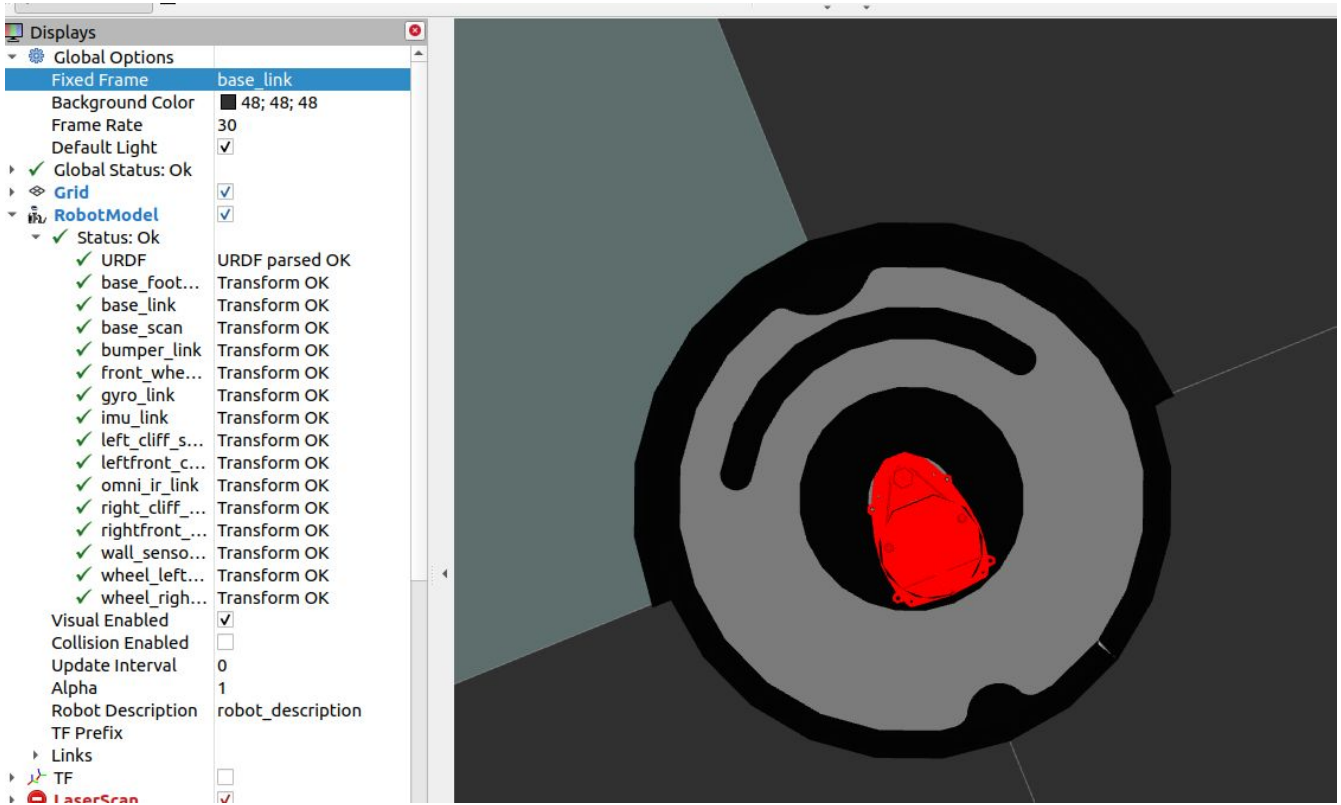
- create_navigation
  - launch
    - amcl.launch
    - create_navigation.launch
    - move_base.launch
  - maps
  - param
    - base_local_planner_params.y...
    - costmap_common_params_b...
    - costmap_common_params_w...
    - costmap_common_params_w...
    - dwa_local_planner_params_b...
    - dwa_local_planner_params_w...
    - dwa_local_planner_params_w...
    - global_costmap_params.yaml
    - local_costmap_params.yaml
    - move_base_params.yaml
  - rviz
    - create_navigation.rviz



SW Architecture: Physical connection



SW Architecture: Physical visualization



SW Architecture: Core launch file in create_navigation package

```
<launch>
  <!-- Arguments -->
  <arg name="model" default="$(env TURTLEBOT3_MODEL)" doc="model type [burger, waffle, waffle_pi]"/>
  <arg name="map_file" default="$(find create_navigation)/maps/map.yaml"/>
  <arg name="open_rviz" default="true"/>
  <arg name="move_forward_only" default="false"/>

  <!-- Lidar -->
  <include file="$(find rplidar_ros)/launch/rplidar_a1.launch">
  </include>

  <!-- Create 2 -->
  <include file="$(find create_bringup)/launch/create_2.launch">
  </include>

  <!-- Map server -->
  <node pkg="map_server" name="map_server" type="map_server" args="$(arg map_file)"/>

  <!-- AMCL -->
  <include file="$(find create_navigation)/launch/amcl.launch"/>

  <!-- move_base -->
  <include file="$(find create_navigation)/launch/move_base.launch">
    <arg name="model" value="$(arg model)" />
    <arg name="move_forward_only" value="$(arg move_forward_only)"/>
  </include>

  <!-- rviz -->
  <group if="$(arg open_rviz)">
    <node pkg="rviz" type="rviz" name="rviz" required="true"
          args="-d $(find create_navigation)/rviz/create_navigation.rviz"/>
  </group>
</launch>
```

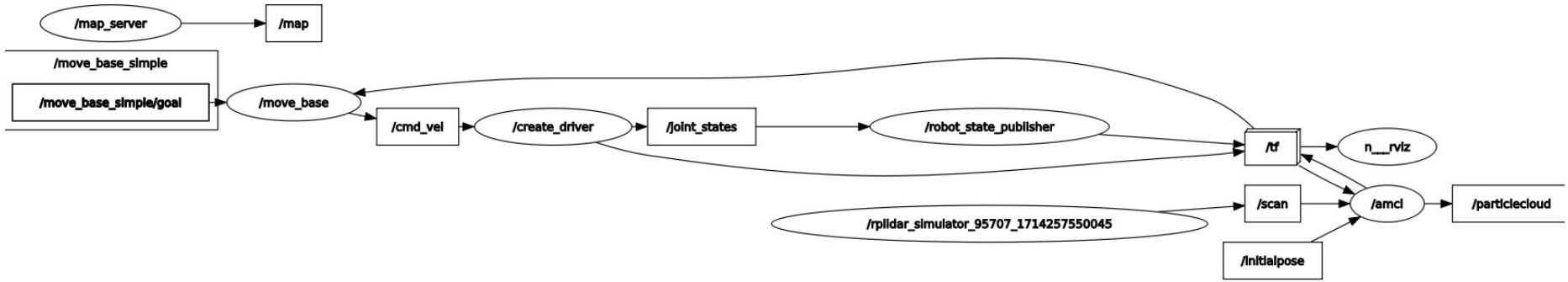
This launch command will automatically perform the following tasks:

- Initialize the lidar a1
- Start the iRobot Create2
- Launch the Map Server
- Run the AMCL (Adaptive Monte Carlo Localization) Node
- Activate the Move Base
- Launch Rviz for visualization

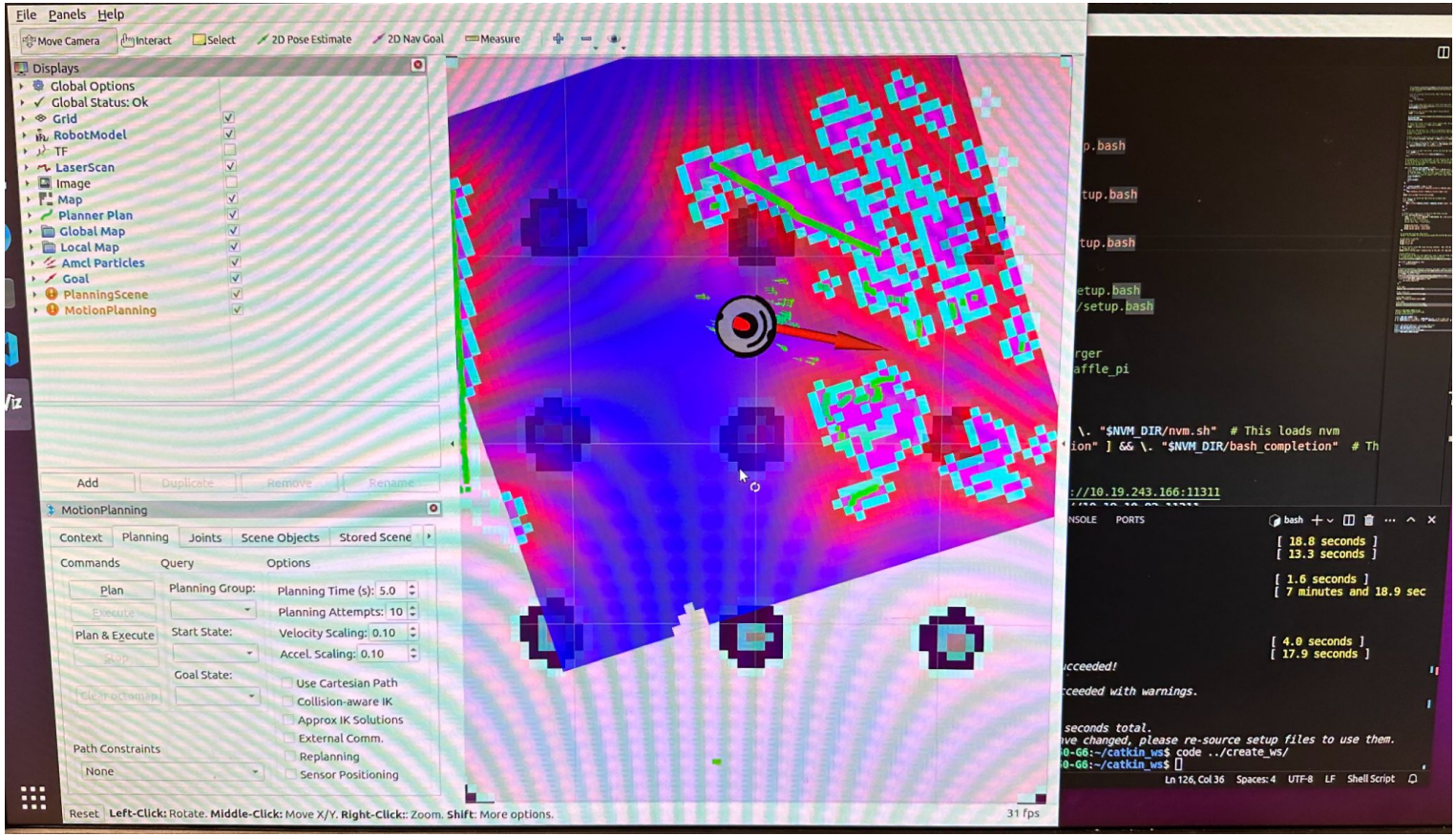
SW Architecture: Topic List

/**amcl**/parameter_descriptions
/**amcl**/parameter_updates
/amcl_pose
/battery/capacity
…
/bumper
/check_led
/clean_button
/cmd_vel
/day_button
/debris_led
/define_song
/diagnostics
/dock
…
/hour_button
/initialpose
/ir_omni
/joint_states
/main_brush_motor
/**map**
/mode
/**move_base**/DWAPlannerROS/global_plan
/move_base/DWAPlannerROS/local_plan
/move_base/NavfnROS/plan
/move_base/current_goal
/move_base/global_costmap/costmap
/move_base/global_costmap/costmap_updates
/move_base/goal
/move_base/…
/particlecloud
/play_song
/power_led
/rosout
/rosout_agg
/**scan**
/set_ascii
/side_brush_motor
/spot_button
/spot_led
/**tf**
/tf_static
/undock

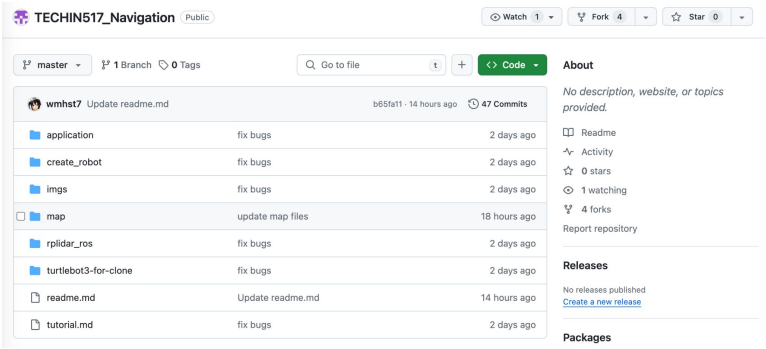
SW Architecture: Nodes and Topics



SW Architecture: Navigation in Rviz successfully



SW Architecture: Open source package for other usage



README

Navigation Stack for Create Robot and Rplidar

Usage Instructions

System Requirements

- Ubuntu 20.04
- ROS 1 Noetic

Installation Steps

1. **Install Turtlebot3 Packages:** Ensure that the Turtlebot3 packages are installed on your system.
2. **Clone Repository**

Clone the repository to your ROS workspace (`src` folder).

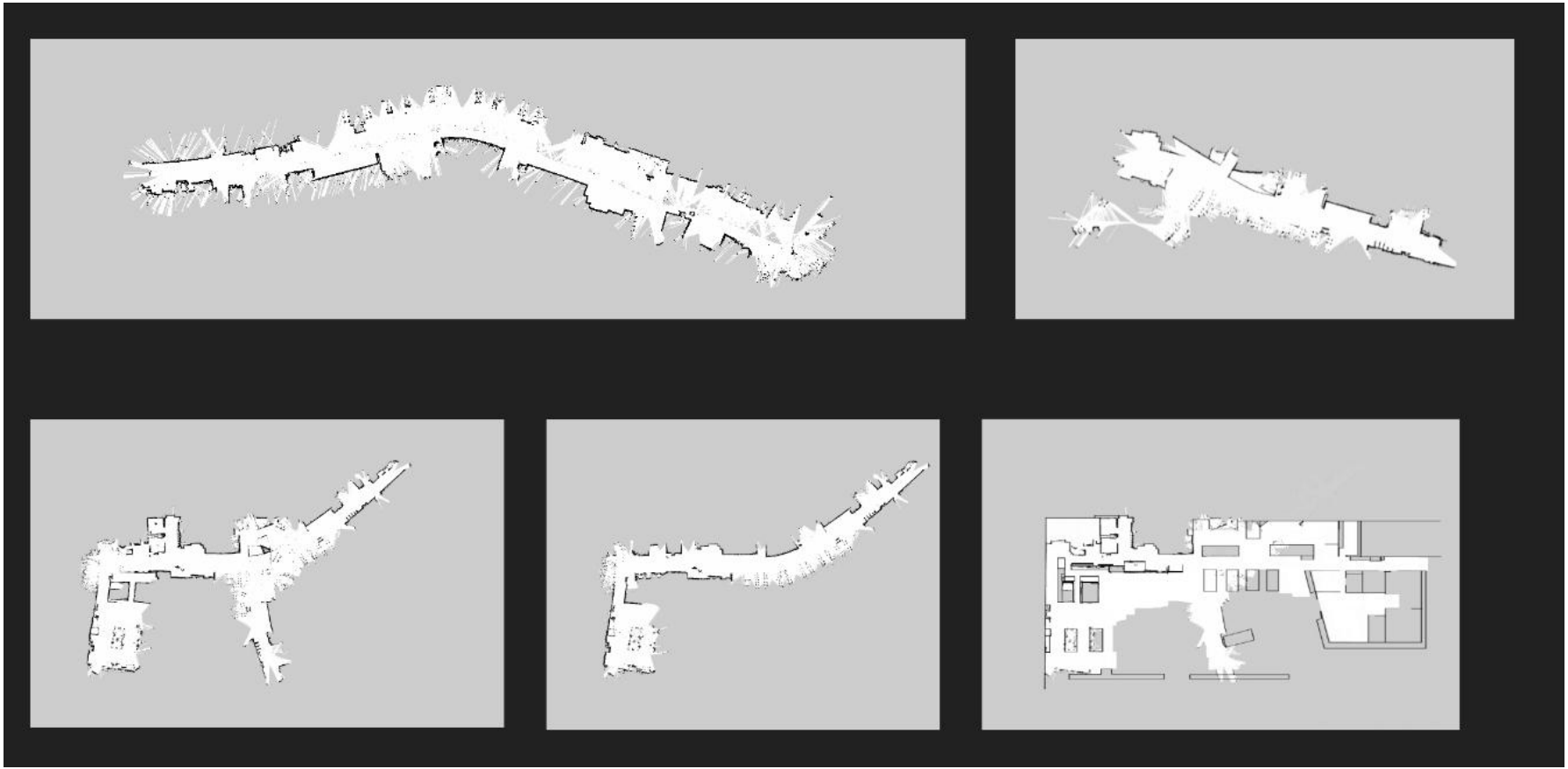
```
git clone https://github.com/SwxTemp/TECHIN517_Navigation.git
```

3. **Update USB Serial Port Names:**

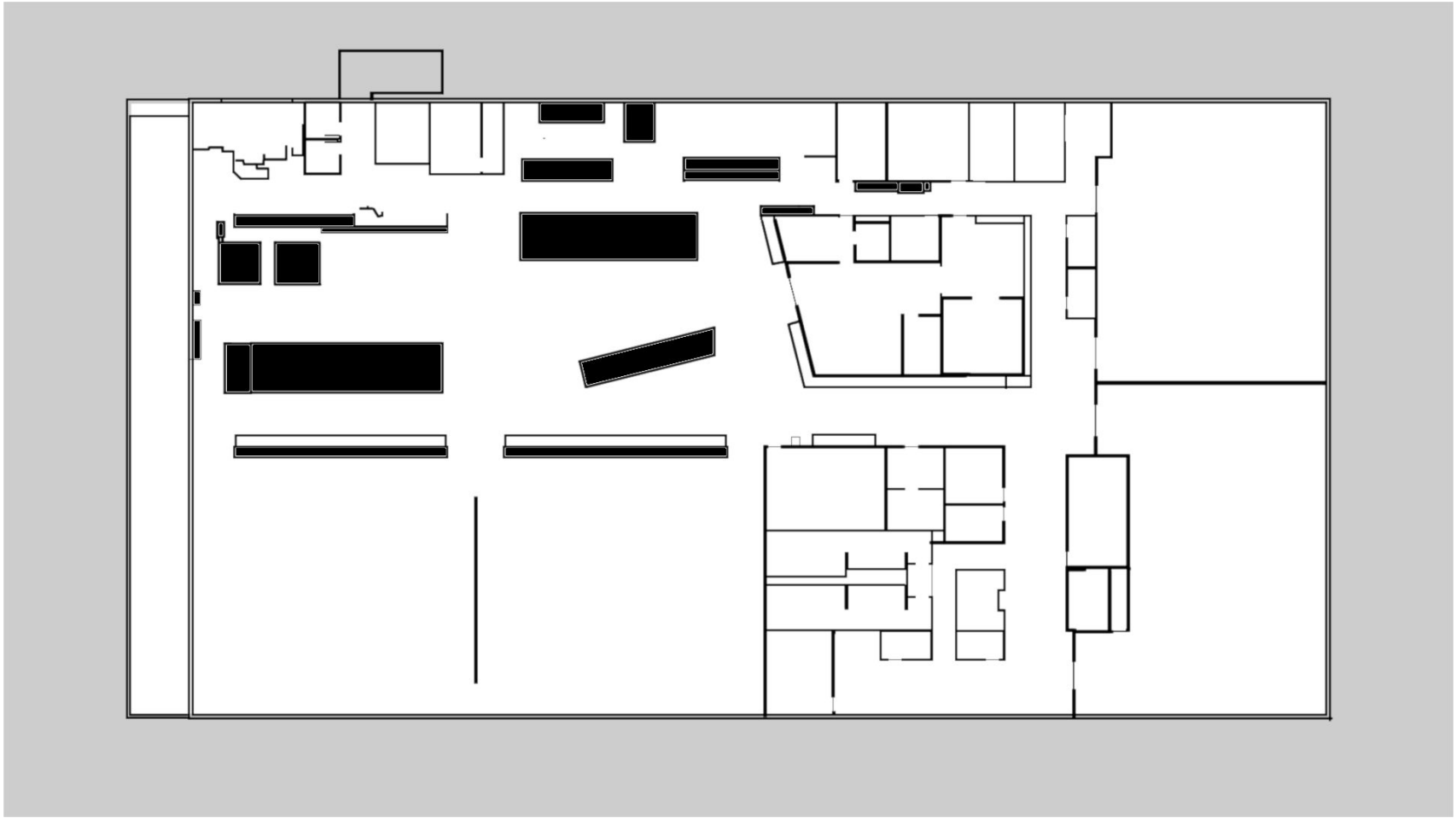
- Navigate to the following files:
  - `create_robot/create_bringup/config/default.yaml`
  - `rplidar_ros/launch/rplidar_a1.launch`
- Update the USB serial port names as needed. Typically, one is named USB1 and the other is named USB0.

4. **Build Workspace:**

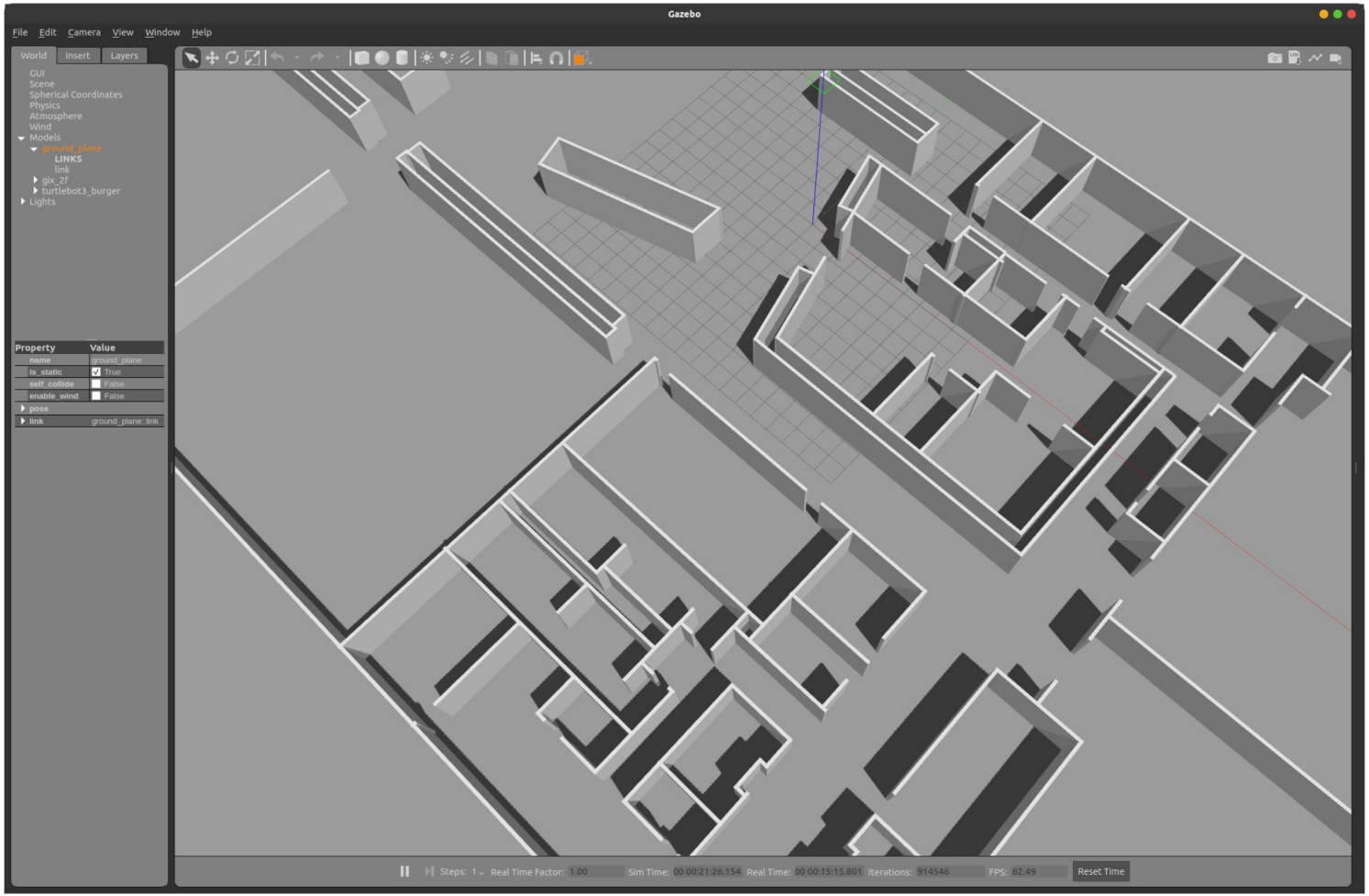
Previous Map



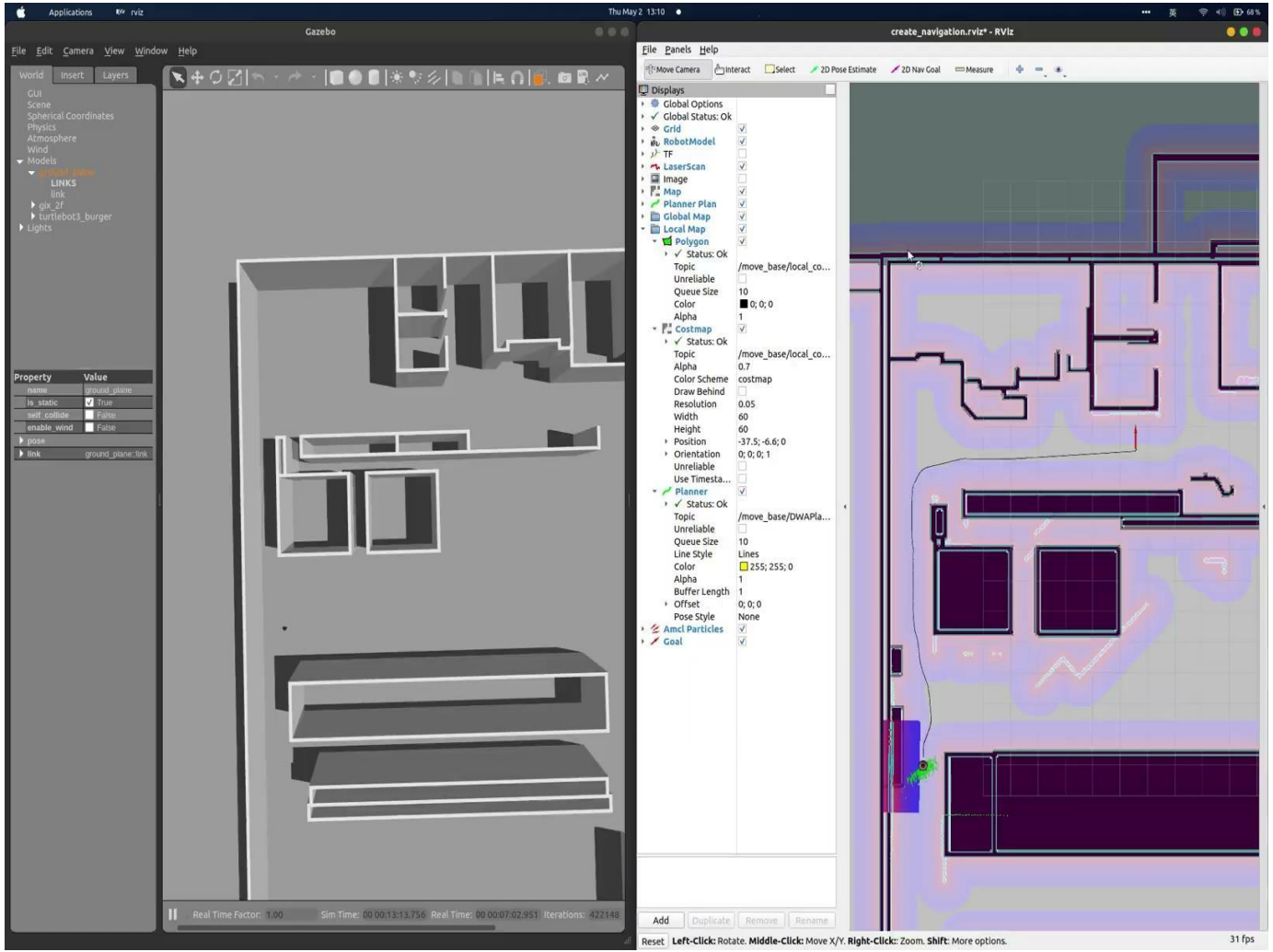
High-Precision Map



High-Precision World Model with Simulation Package



Simulation Demo



Number of successful trips and all attempted trips

Simulation: 10 trips, 10 successful trips
Physical Robot: 5 trips, 2 successful trips

Task completion time

To phone room in simulation: 2.5mins

Physical Navigation Demo

Navigation

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