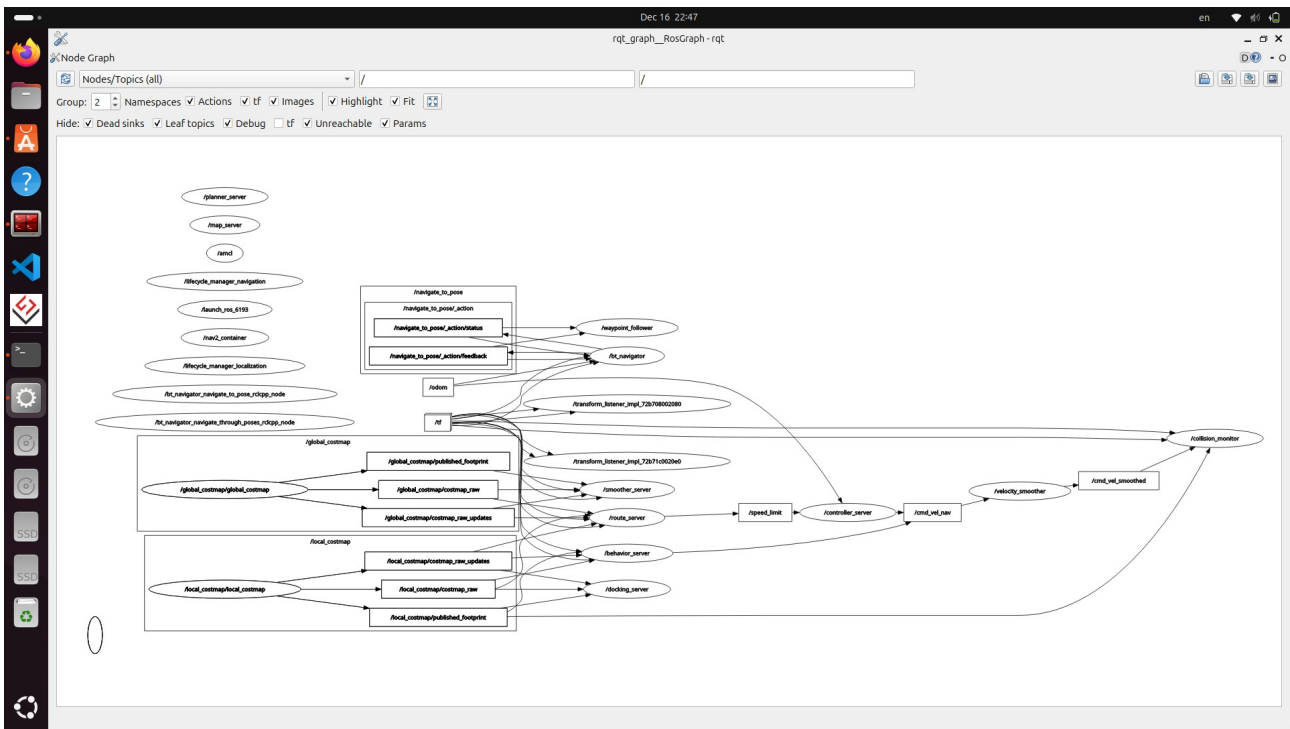


เลือก package ของ ROS2 : nav2\_bringup



nav2\_bringup เป็น package สำหรับ **เรียกใช้งาน (bring up)** ระบบ Navigation 2 ทั้งหมด โดยทำหน้าที่รวม launch file, parameter และ configuration ต่าง ๆ เพื่อให้หุ่นยนต์สามารถ

- วางแผนเส้นทาง (Path Planning)
- หลีกสิ่งกีดขวาง
- เคลื่อนที่ไปยังเป้าหมายอัตโนมัติ

```
mannaaja@manaja: /opt/ros/jazzy/share/nav2_bringup$
xacro
yaml_cpp_vendor
zstd_vendor
(391_web_venv) mannaaja@manaja:~$ colcon
n_cd
Display all 101 possibilities? (y or n)
(391_web_venv) mannaaja@manaja:~$ colcon
n_cd nav2_bringup
(391_web_venv) mannaaja@manaja:/opt/ros
(391_web_venv) mannaaja@manaja:/opt/ros
/jazzy/share/nav2_bringup$
```

package nav2\_bringup ခုန့် : /opt/ros/jazzy/share/nav2\_bringup

```
mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup 113x27
nav2_multirobot_params_all.yaml
nav2_params.yaml
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$ ros2 node list
/amcl
/behavior_server
/bt_navigator
/bt_navigator_navigate_through_poses_rclcpp_node
/bt_navigator_navigate_to_pose_rclcpp_node
/collision_monitor
/controller_server
/docking_server
/global_costmap/global_costmap
/launch_ros_10424
/lifecycle_manager_localization
/lifecycle_manager_navigation
/local_costmap/local_costmap
/map_server
/nav2_container
/planner_server
/route_server
/rqt_gui_py_node_5752
/smooth_server
/transform_listener_impl_77eddc002080
/transform_listener_impl_77ede00020e0
/velocity_smoother
/waypoint_follower
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$
```

node ခုန့်

```
/amcl
/behavior_server
/bt_navigator
/bt_navigator_navigate_through_poses_rclcpp_node
/bt_navigator_navigate_to_pose_rclcpp_node
/collision_monitor
/controller_server
/docking_server
/global_costmap/global_costmap
/launch_ros_10424
/lifecycle_manager_localization
/lifecycle_manager_navigation
/local_costmap/local_costmap
/map_server
/nav2_container
/planner_server
/route_server
/rqt_gui_py_node_5752
/smooth_server
/transform_listener_impl_77eddc002080
/transform_listener_impl_77ede00020e0
/velocity_smoother
/waypoint_follower
```

nav2\_bringup ไม่ได้ประกาศ message ใหม่

แต่ใช้ message มาตรฐาน เช่น:

- geometry\_msgs/msg/PoseStamped
- nav\_msgs/msg/Path
- nav\_msgs/msg/Odometry
- geometry\_msgs/msg/Twist

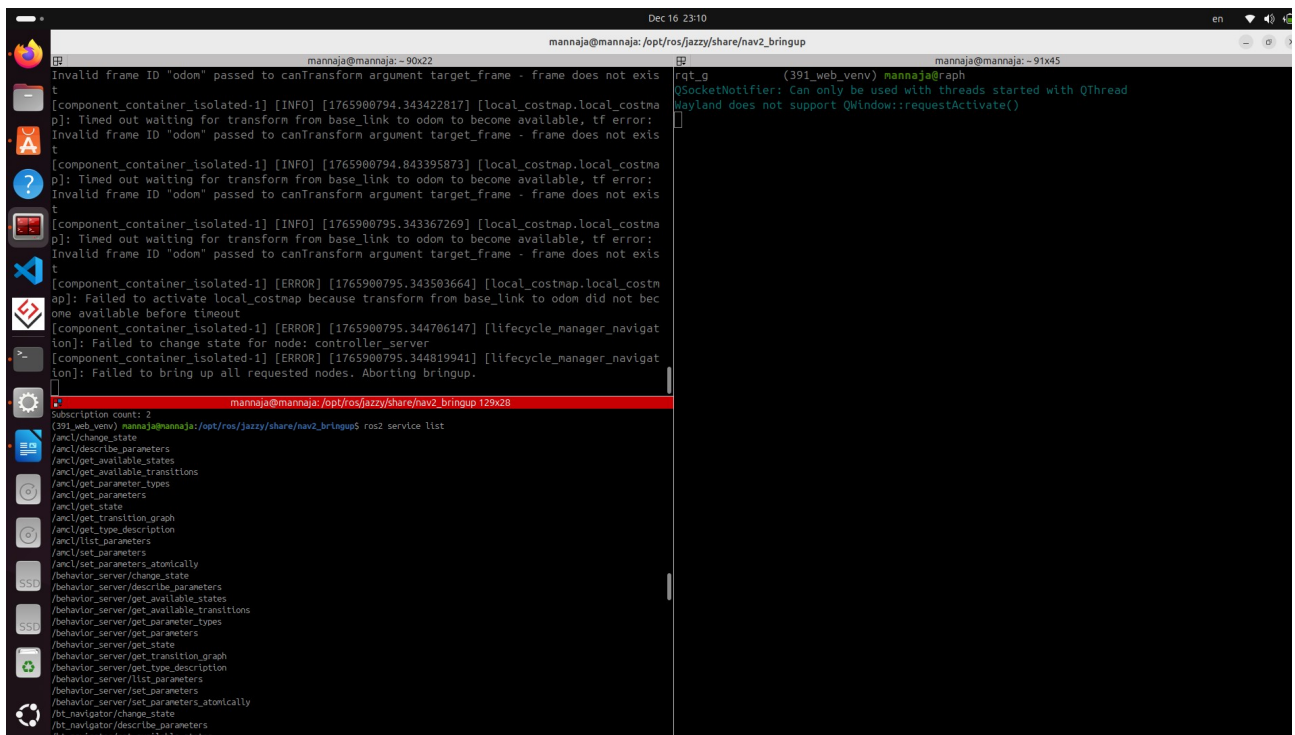
```
mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup 113x27
/collision_monitor/state                /local_costmap/voxel_layer
/collision_monitor/transition_event     /local_costmap/voxel_layer_raw
/controller_server/transition_event     /local_costmap/voxel_layer_raw_updates
/detected_dock_pose                    /local_costmap/voxel_layer_updates
/diagnostics                          /map
/docking_server/transition_event        /map_server/transition_event
/docking_trajectory                   /odom
/dock_pose                           /optimal_trajectory
/filtered_dock_pose                   /parameter_events
/global_costmap/costmap                /plan
/global_costmap/costmap_raw            /planner_server/transition_event
/global_costmap/costmap_raw_updates    /plan_smoothed
/global_costmap/costmap_updates        /preempt_teleop
/global_costmap/footprint              /rosout
/global_costmap/global_costmap/transition_event /route_graph
/global_costmap/obstacle_layer         /route_server/transition_event
/global_costmap/obstacle_layer_raw     /scan
/global_costmap/obstacle_layer_raw_updates /smoother_server/transition_event
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$ ros2 topic info /cmd_vel
Type: geometry_msgs/msg/Twist
Publisher count: 2
Subscription count: 0
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$ ros2 topic info /odom
Type: nav_msgs/msg/Odometry
Publisher count: 0
Subscription count: 2
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$
```

topic ของ nav2\_bringup :

```
mannaja@mannaja: /opt/ros/jazzy/share/nav2_bringup 129x28
Subscription count: 0
(391_web_venv) mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup$ ros2 topic info /
/amcl/transition_event /local_costmap/costmap
/behavior_server/transition_event /local_costmap/costmap_raw
/bt_navigator/transition_event /local_costmap/costmap_raw_updates
/cmd_vel /local_costmap/costmap_updates
/cmd_vel_nav /local_costmap/footprint
/cmd_vel_smoothed /local_costmap/local_costmap/transition_event
/cmd_vel_teleop /local_costmap/published_footprint
/collision_monitor/collision_points_marker /local_costmap/voxel_grid
/collision_monitor_state /local_costmap/voxel_layer
/collision_monitor/transition_event /local_costmap/voxel_layer_raw
/controller_server/transition_event /local_costmap/voxel_layer_raw_updates
/detected_dock_pose /local_costmap/voxel_layer_updates
/diagnostics /map
/docking_server/transition_event /map_server/transition_event
/docking_trajectory /odom
/dock_pose /optimal_trajectory
/filtered_dock_pose /parameter_events
/global_costmap/costmap /plan
/global_costmap/costmap_raw /planner_server/transition_event
/global_costmap/costmap_raw_updates /plan_smoothed
/global_costmap/costmap_updates /preempt_teleop
/global_costmap/footprint /rosout
/global_costmap/global_costmap/transition_event /route_graph
/global_costmap/obstacle_layer /route_server/transition_event
/global_costmap/obstacle_layer_raw /scan
/global_costmap/obstacle_layer_raw_updates /smoother_server/transition_event
(391_web_venv) mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup$ ros2 topic info /cmd_vel
```

```
(391_web_venv) mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup$ ros2 topic info /
/amcl/transition_event /local_costmap/costmap
/behavior_server/transition_event /local_costmap/costmap_raw
/bt_navigator/transition_event /local_costmap/costmap_raw_updates
/cmd_vel /local_costmap/costmap_updates
/cmd_vel_nav /local_costmap/footprint
/cmd_vel_smoothed /local_costmap/local_costmap/transition_event
/cmd_vel_teleop /local_costmap/published_footprint
/collision_monitor/collision_points_marker /local_costmap/voxel_grid
/collision_monitor_state /local_costmap/voxel_layer
/collision_monitor/transition_event /local_costmap/voxel_layer_raw
/controller_server/transition_event /local_costmap/voxel_layer_raw_updates
/detected_dock_pose /local_costmap/voxel_layer_updates
/diagnostics /map
/docking_server/transition_event /map_server/transition_event
/docking_trajectory /odom
/dock_pose /optimal_trajectory
/filtered_dock_pose /parameter_events
/global_costmap/costmap /plan
/global_costmap/costmap_raw /planner_server/transition_event
/global_costmap/costmap_raw_updates /plan_smoothed
/global_costmap/costmap_updates /preempt_teleop
/global_costmap/footprint /rosout
/global_costmap/global_costmap/transition_event /route_graph
/global_costmap/obstacle_layer /route_server/transition_event
/global_costmap/obstacle_layer_raw /scan
/global_costmap/obstacle_layer_raw_updates /smoother_server/transition_event
```

service  $\varnothing\varnothing$  nav2\_bringup :



```
manmaja@mannaia:~$ ros2 service list
Subscription count: 2
(391_web_venv) manmaja@mannaia:~/opt/ros/jazzy/share/nav2_bringup$ ros2 service list
/ancI/change_state
/ancI/describe_parameters
/ancI/get_available_states
/ancI/get_available_transitions
/ancI/get_parameter_types
/ancI/get_parameters
/ancI/get_state
/ancI/get_transition_graph
/ancI/get_type_description
/ancI/list_parameters
/ancI/set_parameters
/ancI/set_parameters_atomically
/behavior_server/change_state
/behavior_server/describe_parameters
/behavior_server/get_available_states
/behavior_server/get_available_transitions
/behavior_server/get_parameter_types
/behavior_server/get_parameters
/behavior_server/get_state
/behavior_server/get_transition_graph
/behavior_server/get_type_description
/behavior_server/list_parameters
/behavior_server/set_parameters
/behavior_server/set_parameters_atomically
/bt_navigator/change_state
/bt_navigator/describe_parameters
/bt_navigator/get_available_states
```

Invalid frame ID "odom" passed to canTransform argument target\_frame - frame does not exist

[component\_container\_isolated-1] [INFO] [1765900794.343422817] [local\_costmap.local\_costmap]: Timed out waiting for transform from base\_link to odom to become available, tf error: Invalid frame ID "odom" passed to canTransform argument target\_frame - frame does not exist

[component\_container\_isolated-1] [INFO] [1765900794.843395873] [local\_costmap.local\_costmap]: Timed out waiting for transform from base\_link to odom to become available, tf error: Invalid frame ID "odom" passed to canTransform argument target\_frame - frame does not exist

[component\_container\_isolated-1] [INFO] [1765900795.343367269] [local\_costmap.local\_costmap]: Timed out waiting for transform from base\_link to odom to become available, tf error: Invalid frame ID "odom" passed to canTransform argument target\_frame - frame does not exist

[component\_container\_isolated-1] [ERROR] [1765900795.343503664] [local\_costmap.local\_costmap]: Failed to activate local\_costmap because transform from base\_link to odom did not become available before timeout

[component\_container\_isolated-1] [ERROR] [1765900795.344706147] [lifecycle\_manager\_navigator]: Failed to change state for node: controller\_server

[component\_container\_isolated-1] [ERROR] [1765900795.344819941] [lifecycle\_manager\_navigator]: Failed to bring up all requested nodes. Aborting bringup.

(391\_web\_venv) manmaja@graph:~\$

QSocketNotifier: Can only be used with threads started with QThread

Wayland does not support QWindow::requestActivate()

mannaja@mannaja: /opt/ros/jazzy/share/nav2\_bringup 129x28

```
/bt_navigator/describe_parameters
/bt_navigator/get_available_states
/bt_navigator/get_available_transitions
/bt_navigator/get_parameter_types
/bt_navigator/get_parameters
/bt_navigator/get_state
/bt_navigator/get_transition_graph
/bt_navigator/get_type_description
/bt_navigator/list_parameters
/bt_navigator/set_parameters
/bt_navigator/set_parameters_atomically
/bt_navigator_navigate_through_poses_rclcpp_node/describe_parameters
/bt_navigator_navigate_through_poses_rclcpp_node/get_parameter_types
/bt_navigator_navigate_through_poses_rclcpp_node/get_parameters
/bt_navigator_navigate_through_poses_rclcpp_node/get_type_description
/bt_navigator_navigate_through_poses_rclcpp_node/list_parameters
/bt_navigator_navigate_through_poses_rclcpp_node/set_parameters
/bt_navigator_navigate_through_poses_rclcpp_node/set_parameters_atomically
/bt_navigator_navigate_to_pose_rclcpp_node/describe_parameters
/bt_navigator_navigate_to_pose_rclcpp_node/get_parameter_types
/bt_navigator_navigate_to_pose_rclcpp_node/get_parameters
/bt_navigator_navigate_to_pose_rclcpp_node/get_type_description
/bt_navigator_navigate_to_pose_rclcpp_node/list_parameters
/bt_navigator_navigate_to_pose_rclcpp_node/set_parameters
/bt_navigator_navigate_to_pose_rclcpp_node/set_parameters_atomically
/collision_monitor/change_state
/collision_monitor/describe_parameters
/collision_monitor/get_available_states
/collision_monitor/get_available_transitions
```

mannaja@mannaja: /opt/ros/jazzy/share/nav2\_bringup 129x28

```
/docking_server/describe_parameters
/docking_server/get_available_states
/docking_server/get_available_transitions
/docking_server/get_parameter_types
/docking_server/get_parameters
/docking_server/get_state
/docking_server/get_transition_graph
/docking_server/get_type_description
/docking_server/list_parameters
/docking_server/reload_database
/docking_server/set_parameters
/docking_server/set_parameters_atomically
/fromLL
/global_costmap/clear_around_global_costmap
/global_costmap/clear_around_pose_global_costmap
/global_costmap/clear_entirely_global_costmap
/global_costmap/clear_except_global_costmap
/global_costmap/get_cost_global_costmap
/global_costmap/get_costmap
/global_costmap/get_obstacle_layer
/global_costmap/get_static_layer
/global_costmap/global_costmap/change_state
/global_costmap/global_costmap/describe_parameters
/global_costmap/global_costmap/get_available_states
/global_costmap/global_costmap/get_available_transitions
/global_costmap/global_costmap/get_parameter_types
/global_costmap/global_costmap/get_parameters
/global_costmap/global_costmap/get_state
/global_costmap/global_costmap/get_transition_graph
```

```
manna@mannaja: /opt/ros/jazzy/share/nav2_bringup 129x28
/global_costmap/global_costmap/get_parameters
/global_costmap/global_costmap/get_state
/global_costmap/global_costmap/get_transition_graph
/global_costmap/global_costmap/get_type_description
/global_costmap/global_costmap/list_parameters
/global_costmap/global_costmap/set_parameters
/global_costmap/global_costmap/set_parameters_atomically
/launch_ros_10424/describe_parameters
/launch_ros_10424/get_parameter_types
/launch_ros_10424/get_parameters
/launch_ros_10424/get_type_description
/launch_ros_10424/list_parameters
/launch_ros_10424/set_parameters
/launch_ros_10424/set_parameters_atomically
/lifecycle_manager_localization/describe_parameters
/lifecycle_manager_localization/get_parameter_types
/lifecycle_manager_localization/get_parameters
/lifecycle_manager_localization/get_type_description
/lifecycle_manager_localization/is_active
/lifecycle_manager_localization/list_parameters
/lifecycle_manager_localization/manage_nodes
/lifecycle_manager_localization/set_parameters
/lifecycle_manager_localization/set_parameters_atomically
/lifecycle_manager_navigation/describe_parameters
/lifecycle_manager_navigation/get_parameter_types
/lifecycle_manager_navigation/get_parameters
/lifecycle_manager_navigation/get_type_description
/lifecycle_manager_navigation/is_active
/lifecycle_manager_navigation/list_parameters
```

```
manna@mannaja: /opt/ros/jazzy/share/nav2_bringup 129x28
/lifecycle_manager_navigation/set_parameters
/lifecycle_manager_navigation/set_parameters_atomically
/local_costmap/clear_around_local_costmap
/local_costmap/clear_around_pose_local_costmap
/local_costmap/clear_entirely_local_costmap
/local_costmap/clear_except_local_costmap
/local_costmap/get_cost_local_costmap
/local_costmap/get_costmap
/local_costmap/get_voxel_layer
/local_costmap/local_costmap/change_state
/local_costmap/local_costmap/describe_parameters
/local_costmap/local_costmap/get_available_states
/local_costmap/local_costmap/get_available_transitions
/local_costmap/local_costmap/get_parameter_types
/local_costmap/local_costmap/get_parameters
/local_costmap/local_costmap/get_state
/local_costmap/local_costmap/get_transition_graph
/local_costmap/local_costmap/get_type_description
/local_costmap/local_costmap/list_parameters
/local_costmap/local_costmap/set_parameters
/local_costmap/local_costmap/set_parameters_atomically
/map_server/change_state
/map_server/describe_parameters
/map_server/get_available_states
/map_server/get_available_transitions
/map_server/get_parameter_types
/map_server/get_parameters
/map_server/get_state
/map_server/get_transition_graph
```



```
mannaja@mannaja: /opt/ros/jazzy/share/nav2_bringup 129x28
/map_server/get_state
/map_server/get_transition_graph
/map_server/get_type_description
/map_server/list_parameters
/map_server/set_parameters
/map_server/set_parameters_atomically
/nav2_container/get_type_description
/planner_server/change_state
/planner_server/describe_parameters
/planner_server/get_available_states
/planner_server/get_available_transitions
/planner_server/get_parameter_types
/planner_server/get_parameters
/planner_server/get_state
/planner_server/get_transition_graph
/planner_server/get_type_description
/planner_server/list_parameters
/planner_server/set_parameters
/planner_server/set_parameters_atomically
/route_server/ReroutingService/reroute
/route_server/change_state
/route_server/describe_parameters
/route_server/get_available_states
/route_server/get_available_transitions
/route_server/get_parameter_types
/route_server/get_parameters
/route_server/get_state
/route_server/get_transition_graph
/route_server/get_type_description
```

```
mannaja@mannaja: /opt/ros/jazzy/share/nav2_bringup 129x28
/rqt_gui_py_node_5752/get_type_description
/rqt_gui_py_node_5752/list_parameters
/rqt_gui_py_node_5752/set_parameters
/rqt_gui_py_node_5752/set_parameters_atomically
/smooth_server/change_state
/smooth_server/describe_parameters
/smooth_server/get_available_states
/smooth_server/get_available_transitions
/smooth_server/get_parameter_types
/smooth_server/get_parameters
/smooth_server/get_state
/smooth_server/get_transition_graph
/smooth_server/get_type_description
/smooth_server/list_parameters
/smooth_server/set_parameters
/smooth_server/set_parameters_atomically
/transform_listener_impl_77eddc002080/get_type_description
/transform_listener_impl_77ede00020e0/get_type_description
/velocity_smoother/change_state
/velocity_smoother/describe_parameters
/velocity_smoother/get_available_states
/velocity_smoother/get_available_transitions
/velocity_smoother/get_parameter_types
/velocity_smoother/get_parameters
/velocity_smoother/get_state
/velocity_smoother/get_transition_graph
/velocity_smoother/get_type_description
/velocity_smoother/list_parameters
/velocity_smoother/set_parameters
```



```
mannaja@mannaja: /opt/ros/jazzy/share/nav2_bringup 129x28
/smoother_server/set_parameters_atomically
/transform_listener_impl_77eddc002080/get_type_description
/transform_listener_impl_77ede00020e0/get_type_description
/velocity_smoother/change_state
/velocity_smoother/describe_parameters
/velocity_smoother/get_available_states
/velocity_smoother/get_available_transitions
/velocity_smoother/get_parameter_types
/velocity_smoother/get_parameters
/velocity_smoother/get_state
/velocity_smoother/get_transition_graph
/velocity_smoother/get_type_description
/velocity_smoother/list_parameters
/velocity_smoother/set_parameters
/velocity_smoother/set_parameters_atomically
/waypoint_follower/change_state
/waypoint_follower/describe_parameters
/waypoint_follower/get_available_states
/waypoint_follower/get_available_transitions
/waypoint_follower/get_parameter_types
/waypoint_follower/get_parameters
/waypoint_follower/get_state
/waypoint_follower/get_transition_graph
/waypoint_follower/get_type_description
/waypoint_follower/list_parameters
/waypoint_follower/set_parameters
/waypoint_follower/set_parameters_atomically
(391_web_venv) mannaja@mannaja: /opt/ros/jazzy/share/nav2_bringup$ =
```

(391\_web\_venv) mannaja@mannaja:/opt/ros/jazzy/share/nav2\_bringup\$ ros2 service list

```
/amcl/change_state
/amcl/describe_parameters
/amcl/get_available_states
/amcl/get_available_transitions
/amcl/get_parameter_types
/amcl/get_parameters
/amcl/get_state
/amcl/get_transition_graph
/amcl/get_type_description
/amcl/list_parameters
/amcl/set_parameters
/amcl/set_parameters_atomically
/behavior_server/change_state
/behavior_server/describe_parameters
/behavior_server/get_available_states
/behavior_server/get_available_transitions
/behavior_server/get_parameter_types
/behavior_server/get_parameters
/behavior_server/get_state
/behavior_server/get_transition_graph
```

/behavior\_server/get\_type\_description  
/behavior\_server/list\_parameters  
/behavior\_server/set\_parameters  
/behavior\_server/set\_parameters\_atomically  
/bt\_navigator/change\_state  
/bt\_navigator/describe\_parameters  
/bt\_navigator/get\_available\_states  
/bt\_navigator/get\_available\_transitions  
/bt\_navigator/get\_parameter\_types  
/bt\_navigator/get\_parameters  
/bt\_navigator/get\_state  
/bt\_navigator/get\_transition\_graph  
/bt\_navigator/get\_type\_description  
/bt\_navigator/list\_parameters  
/bt\_navigator/set\_parameters  
/bt\_navigator/set\_parameters\_atomically  
/bt\_navigator\_navigate\_through\_poses\_rclcpp\_node/describe\_parameters  
/bt\_navigator\_navigate\_through\_poses\_rclcpp\_node/get\_parameter\_types  
/bt\_navigator\_navigate\_through\_poses\_rclcpp\_node/get\_parameters  
/bt\_navigator\_navigate\_through\_poses\_rclcpp\_node/get\_type\_description  
/bt\_navigator\_navigate\_through\_poses\_rclcpp\_node/list\_parameters  
/bt\_navigator\_navigate\_through\_poses\_rclcpp\_node/set\_parameters  
/bt\_navigator\_navigate\_through\_poses\_rclcpp\_node/set\_parameters\_atomically  
/bt\_navigator\_navigate\_to\_pose\_rclcpp\_node/describe\_parameters  
/bt\_navigator\_navigate\_to\_pose\_rclcpp\_node/get\_parameter\_types  
/bt\_navigator\_navigate\_to\_pose\_rclcpp\_node/get\_parameters  
/bt\_navigator\_navigate\_to\_pose\_rclcpp\_node/get\_type\_description  
/bt\_navigator\_navigate\_to\_pose\_rclcpp\_node/list\_parameters  
/bt\_navigator\_navigate\_to\_pose\_rclcpp\_node/set\_parameters  
/bt\_navigator\_navigate\_to\_pose\_rclcpp\_node/set\_parameters\_atomically  
/collision\_monitor/change\_state  
/collision\_monitor/describe\_parameters  
/collision\_monitor/get\_available\_states  
/collision\_monitor/get\_available\_transitions  
/collision\_monitor/get\_parameter\_types  
/collision\_monitor/get\_parameters  
/collision\_monitor/get\_state  
/collision\_monitor/get\_transition\_graph  
/collision\_monitor/get\_type\_description  
/collision\_monitor/list\_parameters  
/collision\_monitor/set\_parameters  
/collision\_monitor/set\_parameters\_atomically  
/collision\_monitor/toggle  
/controller\_server/change\_state  
/controller\_server/describe\_parameters  
/controller\_server/get\_available\_states  
/controller\_server/get\_available\_transitions  
/controller\_server/get\_parameter\_types  
/controller\_server/get\_parameters  
/controller\_server/get\_state  
/controller\_server/get\_transition\_graph  
/controller\_server/get\_type\_description

/controller\_server/list\_parameters  
/controller\_server/set\_parameters  
/controller\_server/set\_parameters\_atomically  
/docking\_server/change\_state  
/docking\_server/describe\_parameters(391\_web\_venv)  
mannaja@mannaja:/opt/ros/jazzy/share/nav2\_bringup\$ ros2 action list  
/assisted\_teleop  
/backup  
/compute\_and\_track\_route  
/compute\_path\_through\_poses  
/compute\_path\_to\_pose  
/compute\_route  
/dock\_robot  
/drive\_on\_heading  
/follow\_gps\_waypoints  
/follow\_path  
/follow\_waypoints  
/navigate\_through\_poses  
/navigate\_to\_pose  
/smooth\_path  
/spin  
/undock\_robot  
/wait  
/docking\_server/get\_available\_states  
/docking\_server/get\_available\_transitions  
/docking\_server/get\_parameter\_types  
/docking\_server/get\_parameters  
/docking\_server/get\_state  
/docking\_server/get\_transition\_graph  
/docking\_server/get\_type\_description  
/docking\_server/list\_parameters  
/docking\_server/reload\_database  
/docking\_server/set\_parameters  
/docking\_server/set\_parameters\_atomically  
/fromLL  
/global\_costmap/clear\_around\_global\_costmap  
/global\_costmap/clear\_around\_pose\_global\_costmap  
/global\_costmap/clear\_entirely\_global\_costmap  
/global\_costmap/clear\_except\_global\_costmap  
/global\_costmap/get\_cost\_global\_costmap  
/global\_costmap/get\_costmap  
/global\_costmap/get\_obstacle\_layer  
/global\_costmap/get\_static\_layer  
/global\_costmap/global\_costmap/change\_state  
/global\_costmap/global\_costmap/describe\_parameters  
/global\_costmap/global\_costmap/get\_available\_states  
/global\_costmap/global\_costmap/get\_available\_transitions  
/global\_costmap/global\_costmap/get\_parameter\_types  
/global\_costmap/global\_costmap/get\_parameters  
/global\_costmap/global\_costmap/get\_state  
/global\_costmap/global\_costmap/get\_transition\_graph  
/global\_costmap/global\_costmap/get\_type\_description

/global\_costmap/global\_costmap/list\_parameters  
/global\_costmap/global\_costmap/set\_parameters  
/global\_costmap/global\_costmap/set\_parameters\_atomically  
/launch\_ros\_10424/describe\_parameters  
/launch\_ros\_10424/get\_parameter\_types  
/launch\_ros\_10424/get\_parameters  
/launch\_ros\_10424/get\_type\_description  
/launch\_ros\_10424/list\_parameters  
/launch\_ros\_10424/set\_parameters  
/launch\_ros\_10424/set\_parameters\_atomically  
/lifecycle\_manager\_localization/describe\_parameters  
/lifecycle\_manager\_localization/get\_parameter\_types  
/lifecycle\_manager\_localization/get\_parameters  
/lifecycle\_manager\_localization/get\_type\_description  
/lifecycle\_manager\_localization/is\_active  
/lifecycle\_manager\_localization/list\_parameters  
/lifecycle\_manager\_localization/manage\_nodes  
/lifecycle\_manager\_localization/set\_parameters  
/lifecycle\_manager\_localization/set\_parameters\_atomically  
/lifecycle\_manager\_navigation/describe\_parameters  
/lifecycle\_manager\_navigation/get\_parameter\_types  
/lifecycle\_manager\_navigation/get\_parameters  
/lifecycle\_manager\_navigation/get\_type\_description  
/lifecycle\_manager\_navigation/is\_active  
/lifecycle\_manager\_navigation/list\_parameters  
/lifecycle\_manager\_navigation/manage\_nodes  
/lifecycle\_manager\_navigation/set\_parameters  
/lifecycle\_manager\_navigation/set\_parameters\_atomically  
/local\_costmap/clear\_around\_local\_costmap  
/local\_costmap/clear\_around\_pose\_local\_costmap  
/local\_costmap/clear\_entirely\_local\_costmap  
/local\_costmap/clear\_except\_local\_costmap  
/local\_costmap/get\_cost\_local\_costmap  
/local\_costmap/get\_costmap  
/local\_costmap/get\_voxel\_layer  
/local\_costmap/local\_costmap/change\_state  
/local\_costmap/local\_costmap/describe\_parameters  
/local\_costmap/local\_costmap/get\_available\_states  
/local\_costmap/local\_costmap/get\_available\_transitions  
/local\_costmap/local\_costmap/get\_parameter\_types  
/local\_costmap/local\_costmap/get\_parameters  
/local\_costmap/local\_costmap/get\_state  
/local\_costmap/local\_costmap/get\_transition\_graph  
/local\_costmap/local\_costmap/get\_type\_description  
/local\_costmap/local\_costmap/list\_parameters  
/local\_costmap/local\_costmap/set\_parameters  
/local\_costmap/local\_costmap/set\_parameters\_atomically  
/map\_server/change\_state  
/map\_server/describe\_parameters  
/map\_server/get\_available\_states  
/map\_server/get\_available\_transitions  
/map\_server/get\_parameter\_types

/map\_server/get\_parameters  
/map\_server/get\_state  
/map\_server/get\_transition\_graph  
/map\_server/get\_type\_description  
/map\_server/list\_parameters  
/map\_server/set\_parameters  
/map\_server/set\_parameters\_atomically  
/nav2\_container/get\_type\_description  
/planner\_server/change\_state  
/planner\_server/describe\_parameters  
/planner\_server/get\_available\_states  
/planner\_server/get\_available\_transitions  
/planner\_server/get\_parameter\_types  
/planner\_server/get\_parameters  
/planner\_server/get\_state  
/planner\_server/get\_transition\_graph  
/planner\_server/get\_type\_description  
/planner\_server/list\_parameters  
/planner\_server/set\_parameters  
/planner\_server/set\_parameters\_atomically  
/route\_server/ReroutingService/reroute  
/route\_server/change\_state  
/route\_server/describe\_parameters  
/route\_server/get\_available\_states  
/route\_server/get\_available\_transitions  
/route\_server/get\_parameter\_types  
/route\_server/get\_parameters  
/route\_server/get\_state  
/route\_server/get\_transition\_graph  
/route\_server/get\_type\_description  
/route\_server/list\_parameters  
/route\_server/set\_parameters  
/route\_server/set\_parameters\_atomically  
/route\_server/set\_route\_graph  
/rqt\_gui\_py\_node\_5752/describe\_parameters  
/rqt\_gui\_py\_node\_5752/get\_parameter\_types  
/rqt\_gui\_py\_node\_5752/get\_parameters  
/rqt\_gui\_py\_node\_5752/get\_type\_description  
/rqt\_gui\_py\_node\_5752/list\_parameters  
/rqt\_gui\_py\_node\_5752/set\_parameters  
/rqt\_gui\_py\_node\_5752/set\_parameters\_atomically  
/smoother\_server/change\_state  
/smoother\_server/describe\_parameters  
/smoother\_server/get\_available\_states  
/smoother\_server/get\_available\_transitions  
/smoother\_server/get\_parameter\_types  
/smoother\_server/get\_parameters  
/smoother\_server/get\_state  
/smoother\_server/get\_transition\_graph  
/smoother\_server/get\_type\_description  
/smoother\_server/list\_parameters  
/smoother\_server/set\_parameters

/smoother\_server/set\_parameters\_atomically  
/transform\_listener\_impl\_77eddc002080/get\_type\_description  
/transform\_listener\_impl\_77ede00020e0/get\_type\_description  
/velocity\_smoother/change\_state  
/velocity\_smoother/describe\_parameters  
/velocity\_smoother/get\_available\_states  
/velocity\_smoother/get\_available\_transitions  
/velocity\_smoother/get\_parameter\_types  
/velocity\_smoother/get\_parameters  
/velocity\_smoother/get\_state  
/velocity\_smoother/get\_transition\_graph  
/velocity\_smoother/get\_type\_description  
/velocity\_smoother/list\_parameters  
/velocity\_smoother/set\_parameters  
/velocity\_smoother/set\_parameters\_atomically  
/waypoint\_follower/change\_state  
/waypoint\_follower/describe\_parameters  
/waypoint\_follower/get\_available\_states  
/waypoint\_follower/get\_available\_transitions  
/waypoint\_follower/get\_parameter\_types  
/waypoint\_follower/get\_parameters  
/waypoint\_follower/get\_state  
/waypoint\_follower/get\_transition\_graph  
/waypoint\_follower/get\_type\_description  
/waypoint\_follower/list\_parameters  
/waypoint\_follower/set\_parameters  
/waypoint\_follower/set\_parameters\_atomically

action ပာဝ် : nav2\_bringup

The screenshot shows a terminal window with a dark background. The top bar indicates the date and time as 'Dec 16 23:15'. The terminal is divided into two main sections. The upper section displays a series of error and info messages from ROS2, including 'Invalid frame ID "odom" passed to canTransform argument target\_frame - frame does not exist', 'Timed out waiting for transform from base\_link to odom to become available, tf error:', and 'Failed to activate local\_costmap because transform from base\_link to odom did not become available before timeout'. The lower section shows a list of ROS2 actions available in the environment, such as '/waypoint\_follower/get\_parameters', '/compute\_and\_track\_route', and '/wait'. The terminal prompt is '(391\_web\_venv) mannaaja@mannaaja:/opt/ros/jazzy/share/nav2\_bringup\$'.

(391\_web\_venv) mannaaja@mannaaja:/opt/ros/jazzy/share/nav2\_bringup\$ ros2 action list

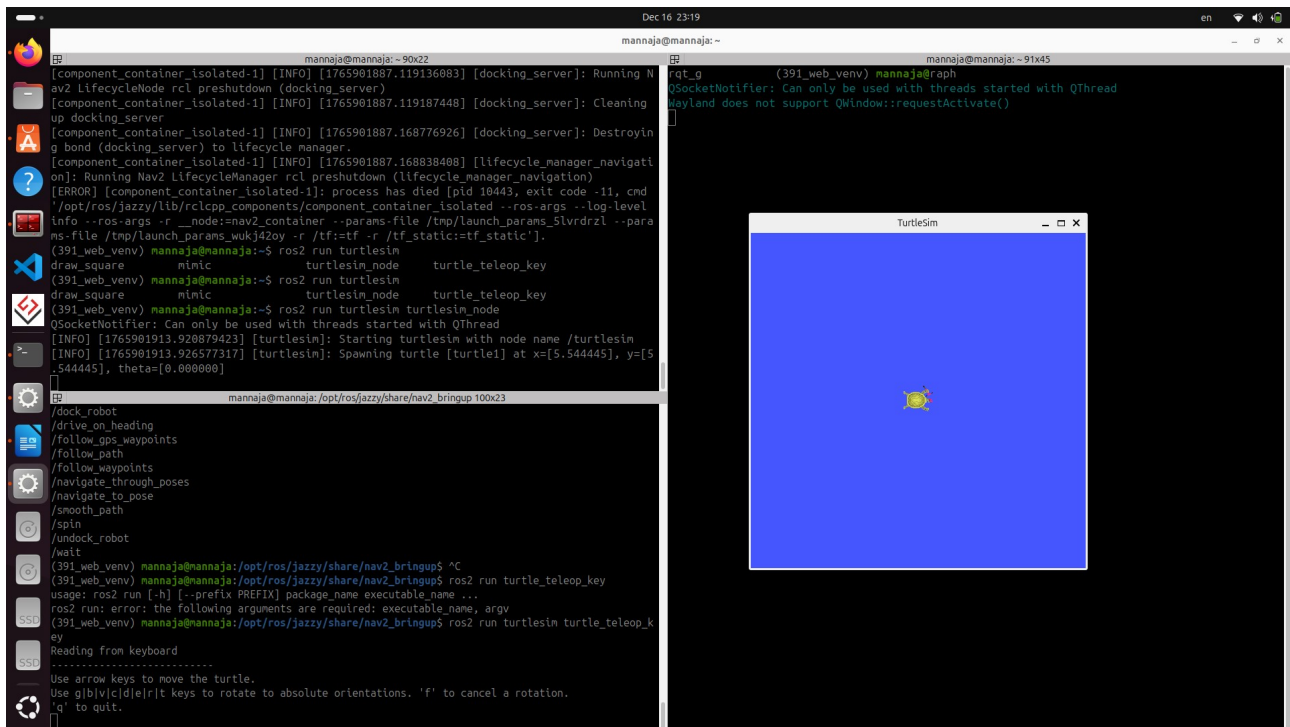
- /assisted\_teleop
- /backup
- /compute\_and\_track\_route
- /compute\_path\_through\_poses
- /compute\_path\_to\_pose
- /compute\_route
- /dock\_robot
- /drive\_on\_heading
- /follow\_gps\_waypoints
- /follow\_path
- /follow\_waypoints
- /navigate\_through\_poses
- /navigate\_to\_pose
- /smooth\_path
- /spin
- /undock\_robot
- /wait

### etc. (Launch & Parameter)

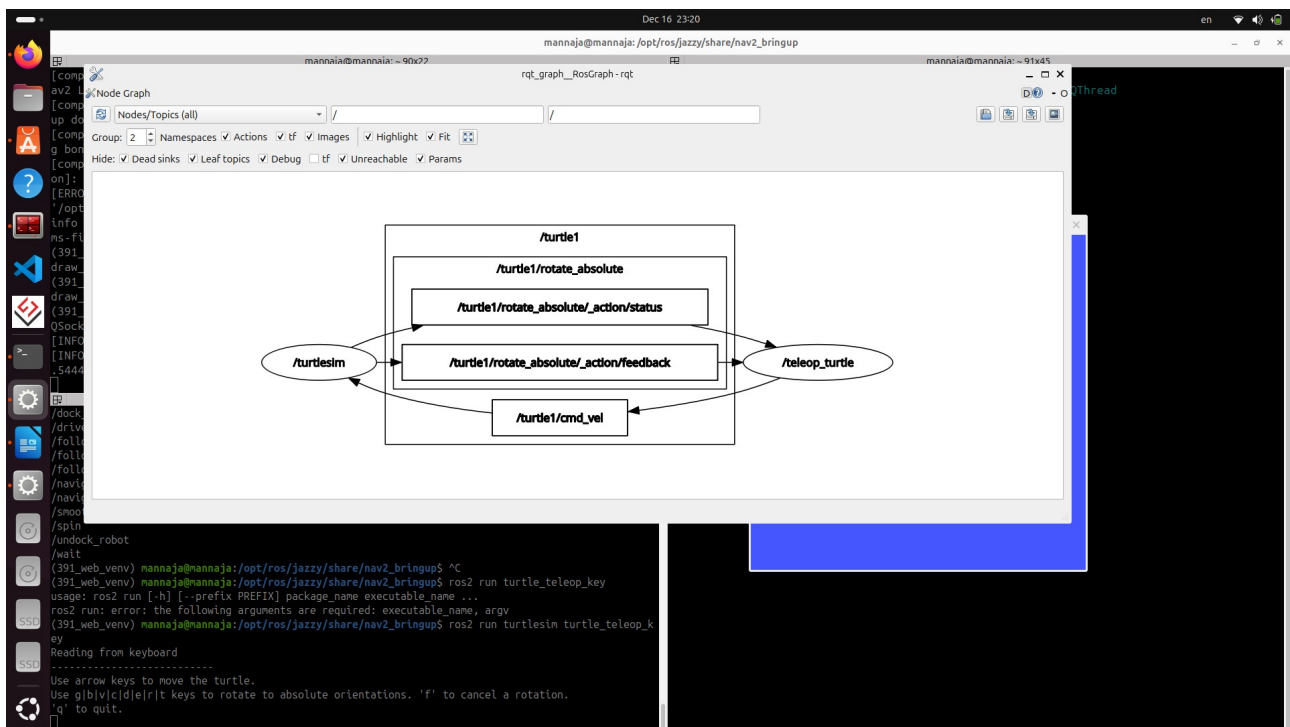
- ใช้ Python launch file
- ใช้ parameter จากไฟล์ .yaml
- รองรับ use\_sim\_time
- สามารถปรับ planner, controller ได้จาก config



## ให้ออนรับ turtle\_sim พร้อม teleop\_twist\_keyboard



rqt\_graph :



ใช้ปุ่ม ลูกศร เพื่อเดินไปด้านต่างๆ โดย

ลูกศรขึ้น คือ เดินหน้า

ลูกศรลง คือ ถอยหลัง

ลูกศรซ้าย คือ เลี้ยวซ้าย

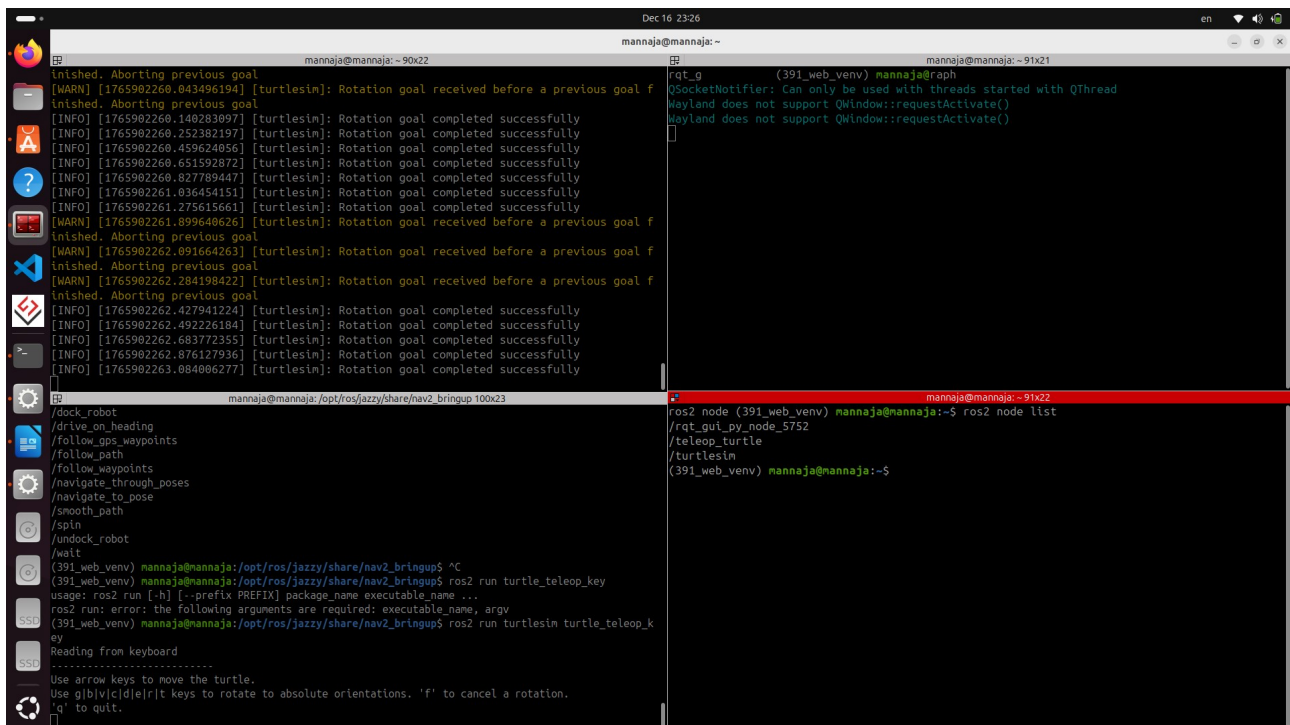
ลูกศรขวา คือ เลี้ยวขวา

g b v c d e r t → หมุนเต่าไปทิศทางที่กำหนดไว้ล่วงหน้า

f → ยกเลิกคำสั่งหมุน / เดิน

q → ออก

node ที่ใช้ :



```
manmaja@manmaja: ~$ ros2 node list
(391_web_venv) manmaja@manmaja:~$ ros2 node list
/rqt_gui_py_node_5752
/teleop_turtle
/turtlesim
(391_web_venv) manmaja@manmaja:~$
```

```
manmaja@manmaja: /opt/ros/jazzy/share/nav2_bringup$ ros2 run turtlesim turtlesim
[1765902260.043496194] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[1765902260.140283097] [turtlesim]: Rotation goal completed successfully
[1765902260.252382197] [turtlesim]: Rotation goal completed successfully
[1765902260.459624056] [turtlesim]: Rotation goal completed successfully
[1765902260.651592872] [turtlesim]: Rotation goal completed successfully
[1765902260.827789447] [turtlesim]: Rotation goal completed successfully
[1765902261.036454151] [turtlesim]: Rotation goal completed successfully
[1765902261.275615661] [turtlesim]: Rotation goal completed successfully
[1765902261.899640626] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[1765902262.091664263] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[1765902262.284198422] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[1765902262.427941224] [turtlesim]: Rotation goal completed successfully
[1765902262.492226184] [turtlesim]: Rotation goal completed successfully
[1765902262.683772355] [turtlesim]: Rotation goal completed successfully
[1765902262.876127936] [turtlesim]: Rotation goal completed successfully
[1765902263.084006277] [turtlesim]: Rotation goal completed successfully
```

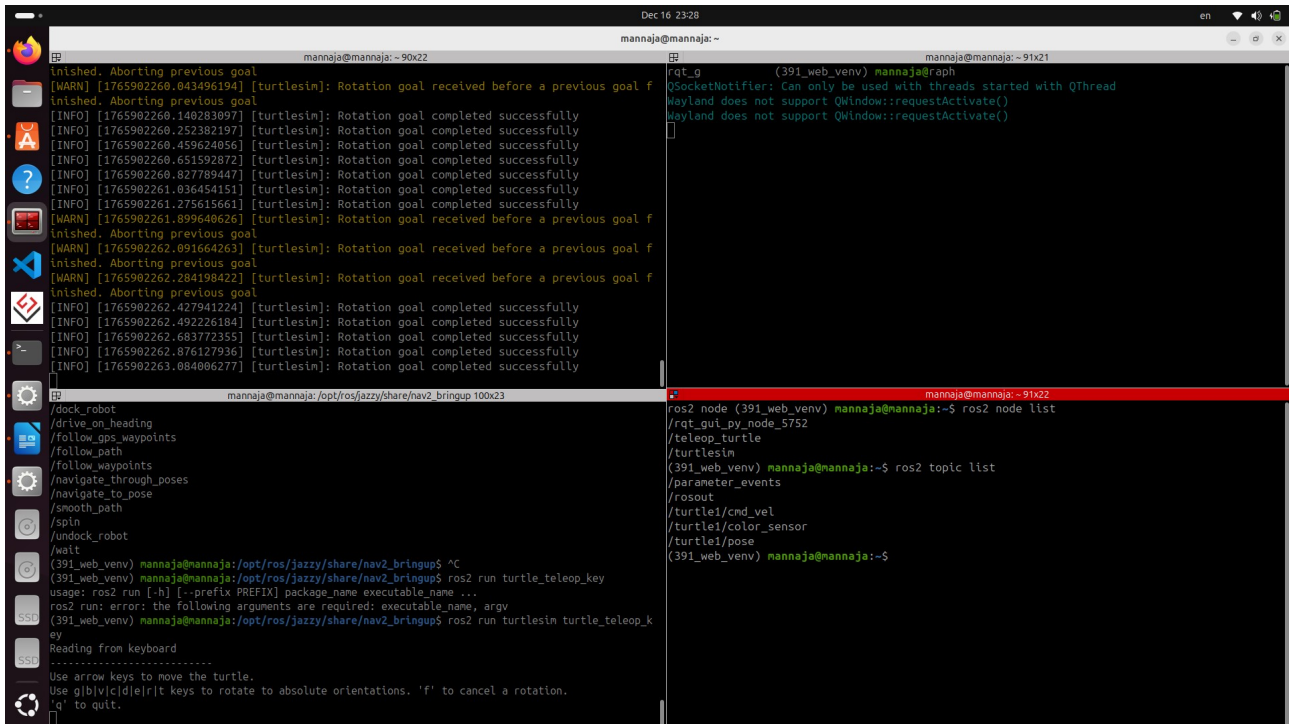
/teleop\_turtle

/turtlesim

teleop\_turtle คือ ไว้สำหรับคุมการเคลื่อนที่ของเต่า

turtlesim คือ node แสดงผลของเต่า

topic ที่ใช้ :



The screenshot shows a terminal window with three panes. The left pane displays a list of navigation actions: /dock\_robot, /drive\_on\_heading, /follow\_gps\_waypoints, /follow\_path, /follow\_waypoints, /navigate\_through\_poses, /navigate\_to\_pose, /smooth\_path, /spin, /undock\_robot, /wait. The middle pane shows a series of log messages from the turtlesim node, indicating that rotation goals were received and completed successfully. The right pane shows the output of the 'ros2 node list' and 'ros2 topic list' commands. The 'ros2 node list' command shows the following nodes: /rqt\_gui\_py\_node\_5752, /teleop\_turtle, /turtlesim, and (391\_web\_venv) mannaaja@mannaaja. The 'ros2 topic list' command shows the following topics: /parameter\_events, /rosout, /turtle1/cmd\_vel, /turtle1/color\_sensor, and /turtle1/pose.

```
mannaaja@mannaaja: ~ 90x22
[WARN] [1765982260.043496194] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[INFO] [1765982260.140283897] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982260.252382197] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982260.458624856] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982260.651592872] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982260.827789447] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982261.036454151] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982261.275615661] [turtlesim]: Rotation goal completed successfully
[WARN] [1765982261.899640626] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[WARN] [1765982262.091664263] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[WARN] [1765982262.284198422] [turtlesim]: Rotation goal received before a previous goal finished. Aborting previous goal
[INFO] [1765982262.427941224] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982262.492226184] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982262.683772355] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982262.876127936] [turtlesim]: Rotation goal completed successfully
[INFO] [1765982263.084086277] [turtlesim]: Rotation goal completed successfully

mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup 100x23
~/wait
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$ ^C
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$ ros2 run turtle_teleop_key
usage: ros2 run [-h] [-i-prefix PREFIX] package_name executable_name ...
ros2 run: error: the following arguments are required: executable_name, argv
(391_web_venv) mannaaja@mannaaja: /opt/ros/jazzy/share/nav2_bringup$ ros2 run turtlesim turtle_teleop_key
Reading from keyboard
.....
Use arrow keys to move the turtle.
Use g[h]v[c]d[e]r[t] keys to rotate to absolute orientations. 'f' to cancel a rotation.
'q' to quit.

mannaaja@mannaaja: ~ 91x21
(391_web_venv) mannaaja@raph
QSocketNotifier: Can only be used with threads started with QThread
Wayland does not support QWindow::requestActivate()
Wayland does not support QWindow::requestActivate()

ros2 node (391_web_venv) mannaaja@mannaaja:~$ ros2 node list
/rqt_gui_py_node_5752
/teleop_turtle
/turtlesim
(391_web_venv) mannaaja@mannaaja:~$ ros2 topic list
/parameter_events
/rosout
/turtle1/cmd_vel
/turtle1/color_sensor
/turtle1/pose
(391_web_venv) mannaaja@mannaaja:~$
```

/turtle1/cmd\_vel

/turtle1/color\_sensor

/turtle1/pose

turtle1/cmd\_vel คือ topic สำหรับการส่งความเร็วต่างๆ ของเต่า

turtle1/color\_sensor คือ topic สำหรับสีต่างๆ ของเต่า และพื้นหลังของเต่า

turtle1/pose คือ topic สำหรับแสดงผลว่าเต่าอยู่ที่ตำแหน่งที่เท่าไรของจอ