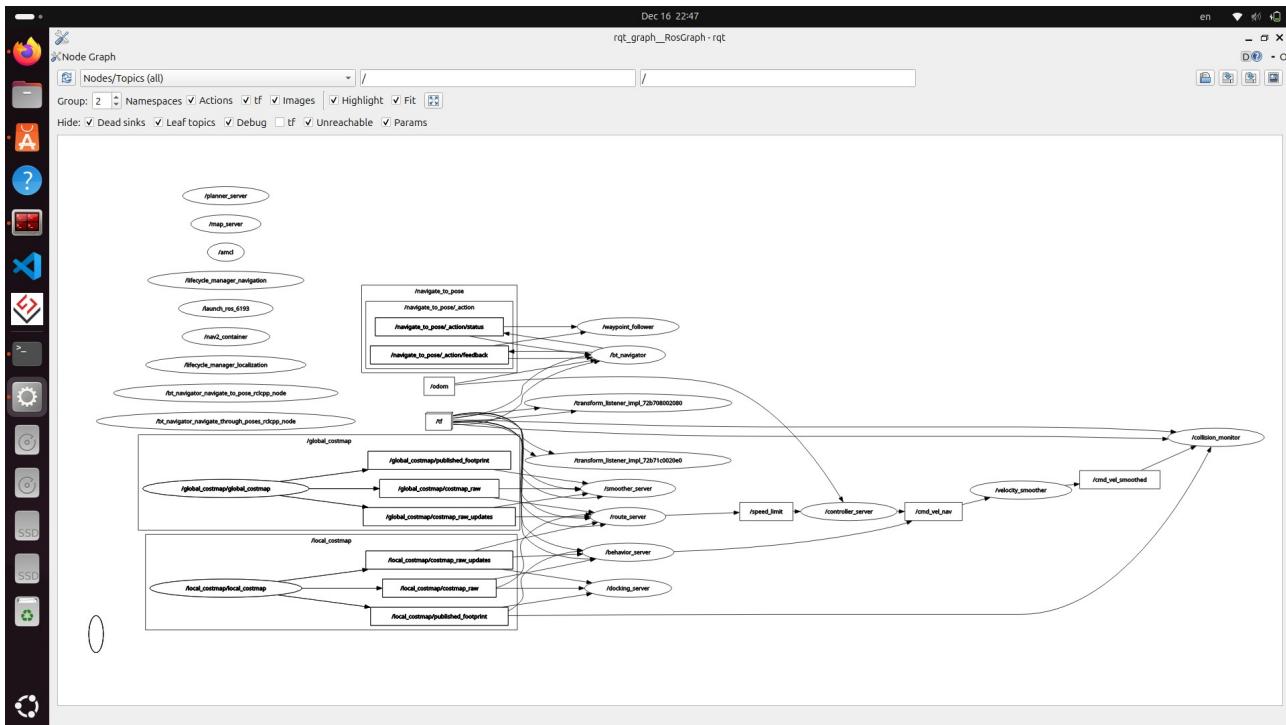


เลือก package ของ ROS2 : nav2_bringup



nav2_bringup เป็น package สำหรับ **เรียกใช้งาน (bring up)** ระบบ Navigation 2 ทั้งหมด โดยกำหนดที่รวม launch file, parameter และ configuration ต่าง ๆ เพื่อให้หุ่นยนต์สามารถ

- วางแผนเส้นทาง (Path Planning)
- หลีกสิ่งกีดขวาง
- เคลื่อนที่ไปยังเป้าหมายอัตโนมัติ

```
manna@mannaja:/opt/ros/jazzy/share/nav2_bringup$ source /opt/ros/jazzy/setup.bash
manna@mannaja:/opt/ros/jazzy/share/nav2_bringup$ cd ..
manna@mannaja:/opt/ros/jazzy/share$ ls
yaml_cpp_vendor
zstd_vendor
(391_web_venv) manna@mannaja:~/opt/ros/jazzy/share$ cd ..
manna@mannaja:~/opt/ros/jazzy/share$ ls
nav2_bringup
(391_web_venv) manna@mannaja:/opt/ros/jazzy/share$
```

package nav2_bringup ອີງກີ່ : /opt/ros/jazzy/share/nav2_bringup

```
mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup 113x27
nav2_multirobot_params_all.yaml
nav2_params.yaml
(391_web_venv) mannaja@mannaja:/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_smoothen
/waypoint_follower
(391_web_venv) mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup$
```

node ຈະນີ

```
/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_smoothen
/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

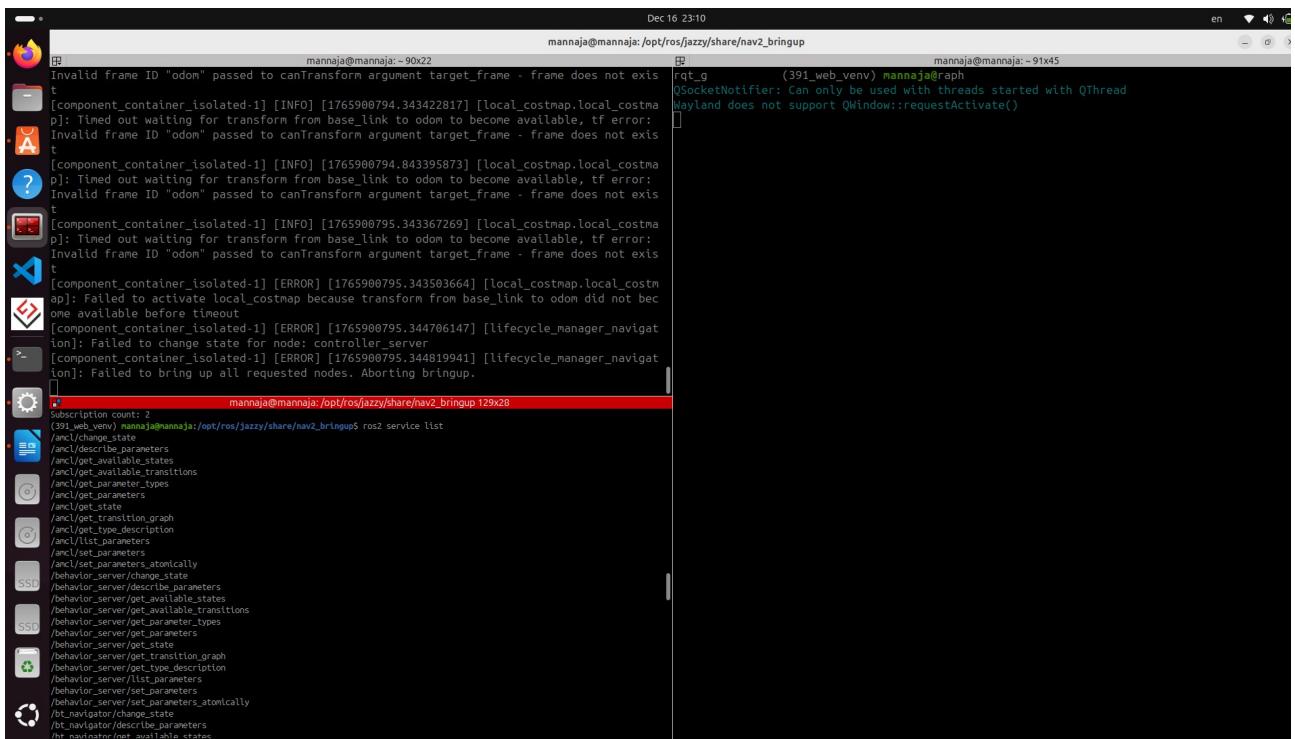
```
mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup 113x27
/collision_monitor_state           /local_costmap/voxel_layer
/collision_monitor/transition_event /local_costmap/voxel_layer_raw
/controller_server/transition_event /local_costmap/voxel_layer_raw_updates
/detected_dock_pose                /local_costmap/voxel_layer_updates
/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) mannaja@mannaja:/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) mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup$ ros2 topic info /odom
Type: nav_msgs/msg/Odometry
Publisher count: 0
Subscription count: 2
(391_web_venv) mannaja@mannaja:/opt/ros/jazzy/share/nav2_bringup$
```

topic ของ nav2_bringup :

```
manna@mannaja: /opt/ros/jazzy/share/nav2 Bringup 129x28
Subscription count: 0
(391_web_venv) manna@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) manna@mannaja:/opt/ros/jazzy/share/nav2 Bringup$ ros2 topic info /cmd_vel
```

```
(391_web_venv) manna@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 սԵՎ nav2 Bringup :



The screenshot shows a terminal window with two panes. The left pane displays the output of the command `ros2 service list`, which lists various services provided by the navigation stack. The right pane shows the logs from the `nav2_bringup` service, which includes several `[INFO]` messages and one `[ERROR]` message indicating that the `local_costmap` failed to activate because the transform from `base_link` to `odom` did not become available within the specified timeout.

```
Dec 16 23:10 mannaja@mannaja:~ 90x22
mannaja@mannaja:~ 90x22
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]
p: 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]
p: 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]
p: 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]
ap: 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_navigation]
Failed to change state for node: controller_server
[component_container_isolated-1] [ERROR] [1765900795.344819941] [lifecycle_manager_navigation]
Failed to bring up all requested nodes. Aborting bringup.

Subscription count: 2
(391_web_venv) mannaja@mannaja:~/opt/ros/jazzy/share/nav2_bringup$ ros2 service list
/anc1/change_state
/anc1/get_available_markers
/anc1/get_available_states
/anc1/get_available_transitions
/anc1/get_parameter_descriptions
/anc1/get_parameters
/anc1/get_state
/anc1/get_transition_graph
/anc1/get_type_descriptions
/anc1/list_parameters
/anc1/set_parameters
/anc1/set_parameters_atomically
/behavior_server/change_state
/behavior_server/get_describe_parameters
/behavior_server/get_available_states
/behavior_server/get_available_transitions
/behavior_server/get_parameter_descriptions
/behavior_server/get_parameters
/behavior_server/get_state
/behavior_server/get_transition_graph
/behavior_server/get_type_descriptions
/behavior_server/list_parameters
/behavior_server/set_parameters
/behavior_server/set_parameters_atomically
/hk_navigator/get_state
/hk_navigator/get_describe_parameters
/hk_navigator/get_available_states
```

```
Dec 16 23:10 mannaja@mannaja:~/opt/ros/jazzy/share/nav2_bringup
mannaja@mannaja:~/opt/ros/jazzy/share/nav2_bringup
qt_g (391_web_venv) mannaja@raph
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
```

```
mannaaja@mannaaja: /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
```

```
mannaaja@mannaaja: /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_smoothen/change_state
/velocity_smoothen/describe_parameters
/velocity_smoothen/get_available_states
/velocity_smoothen/get_available_transitions
/velocity_smoothen/get_parameter_types
/velocity_smoothen/get_parameters
/velocity_smoothen/get_state
/velocity_smoothen/get_transition_graph
/velocity_smoothen/get_type_description
/velocity_smoothen/list_parameters
/velocity_smoothen/set_parameters
```

```
mannaaja@mannaaja: /opt/ros/jazzy/share/nav2 Bringup 129x28
/smooth_server/set_parameters_atomically
/transform_listener_77eddc002080/get_type_description
/transform_listener_77ede00020e0/get_type_description
/velocity_smoothen/change_state
/velocity_smoothen/describe_parameters
/velocity_smoothen/get_available_states
/velocity_smoothen/get_available_transitions
/velocity_smoothen/get_parameter_types
/velocity_smoothen/get_parameters
/velocity_smoothen/get_state
/velocity_smoothen/get_transition_graph
/velocity_smoothen/get_type_description
/velocity_smoothen/list_parameters
/velocity_smoothen/set_parameters
/velocity_smoothen/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) mannaaja@mannaaja:/opt/ros/jazzy/share/nav2 Bringup$
```

```
(391_web_venv) mannaaja@mannaaja:/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_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_smoothen/change_state
/velocity_smoothen/describe_parameters
/velocity_smoothen/get_available_states
/velocity_smoothen/get_available_transitions
/velocity_smoothen/get_parameter_types
/velocity_smoothen/get_parameters
/velocity_smoothen/get_state
/velocity_smoothen/get_transition_graph
/velocity_smoothen/get_type_description
/velocity_smoothen/list_parameters
/velocity_smoothen/set_parameters
/velocity_smoothen/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 սօն : nav2_bringup

```

mannaja@mannaja:~$ ros2 action list
[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

```

```

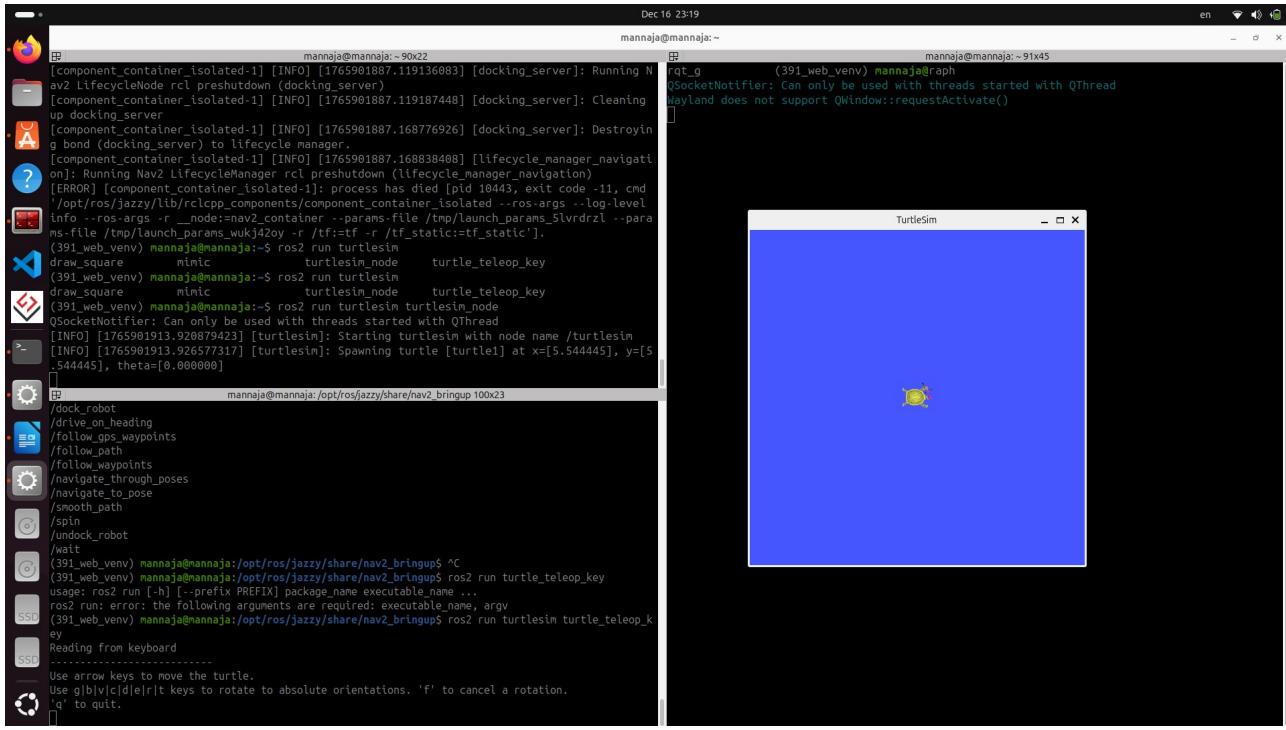
(391_web_venv) mannaja@mannaja:/opt/ros/jazzy/share/nav2 Bringup$ ros2 action list
/assisted_teleop
/backup
/compute_and_track_route
/compute_path_through_poses
/compute_path_to_pose
/compute_route
/dock_robot
/drive_on_heading
/follow_gps_waypoints
/follow_path
/follow_waypoints
/navigate_through_poses
/navigate_to_pose
/smooth_path
/spin
/undock_robot
/wait

```

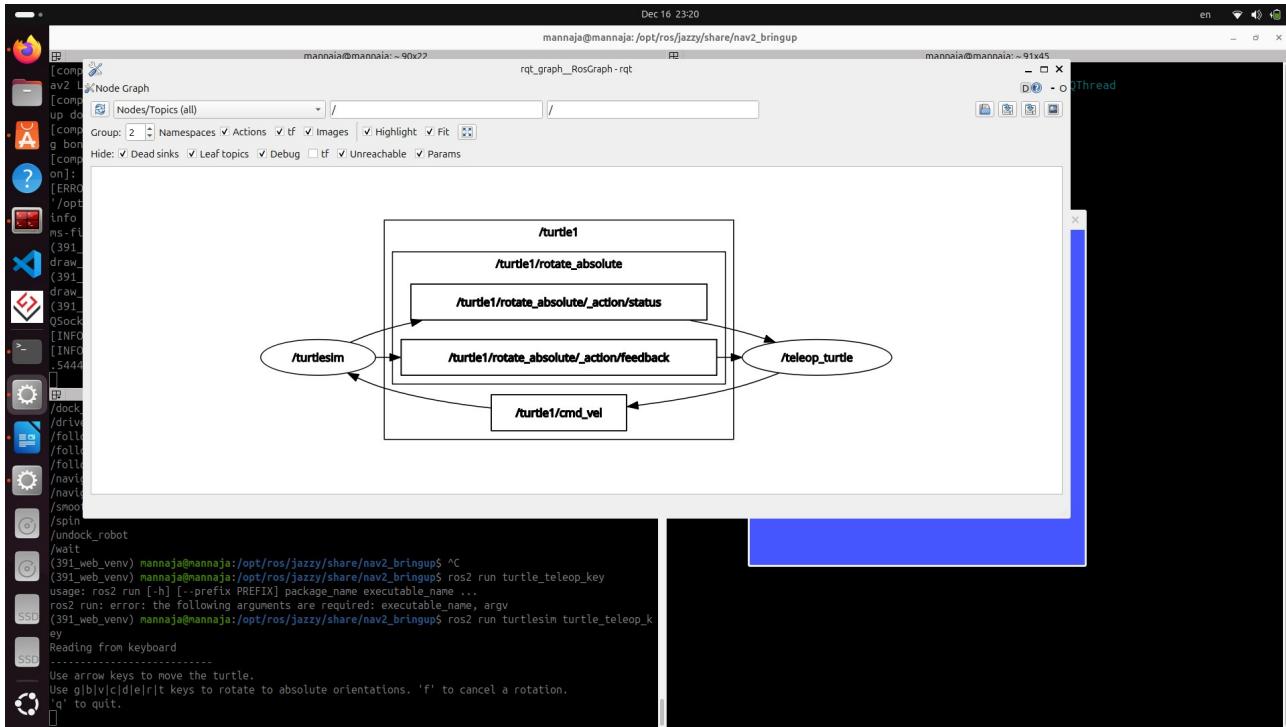
etc. (Launch & Parameter)

- ใช้ Python launch file
- ใช้ parameter จากไฟล์ .yaml
- รองรับ use_sim_time
- สามารถปรับ planner, controller ได้จาก config

ໃຫ້ລອງຮັບ turtle_sim ພໍລົມ 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 :

The screenshot shows two terminal windows. The left window displays logs from several ROS nodes, primarily related to turtle movement and rotation goals. The right window shows the output of the command `ros2 node list`, which lists nodes like `rqt_g`, `rqt_gui_py_node_5752`, `/teleop_turtle`, and `/turtlesim`.

```
manna@mannaj:~ 90x22
[WARN] [1765902266.043496194] [turtlesim]: Rotation goal received before a previous goal f
[INFO] [1765902266.140283097] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902266.252382197] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902266.459624056] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902266.651592872] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902266.827789447] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902266.036454151] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902261.275615661] [turtlesim]: Rotation goal completed successfully
[WARN] [1765902261.899640626] [turtlesim]: Rotation goal received before a previous goal f
[INFO] [1765902262.091664263] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902262.492226184] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902262.683772355] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902262.876127936] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902263.084006277] [turtlesim]: Rotation goal completed successfully

manna@mannaj:~/opt/ros/jazzy/share/nav2 Bringup 100x23
dock_robot
/drive_on_heading
/follow_gps_waypoints
/follow_path
/follow waypoints
/navigate_through_poses
/navigate_to_pose
/smooth_path
/spin
/undock_robot
/wall

(391_web_venv) manna@mannaj:~/opt/ros/jazzy/share/nav2 Bringup$ ^C
(391_web_venv) manna@mannaj:~/opt/ros/jazzy/share/nav2 Bringup$ ros2 run turtle_teleop key
usage: ros2 run [-h] [-p PREFIX] package_name executable_name ...
ros2 run: error: the following arguments are required: executable_name, arg
(391_web_venv) manna@mannaj:~/opt/ros/jazzy/share/nav2 Bringup$ ros2 run turtlesim turtle_teleop key
Reading from keyboard
-----
Use arrow keys to move the turtle.
Use g|b|v|c|d|e|r|t keys to rotate to absolute orientations. 'f' to cancel a rotation.
'q' to quit.

manna@mannaj:~ 91x22
rqt_g (391_web_venv) manna@mannaj:~$ ros2 node list
/rqt_gui_py_node_5752
/teleop_turtle
/turtlesim
(391_web_venv) manna@mannaj:~$
```

/teleop_turtle

/turtlesim

teleop_turtle คือ ใช้สำหรับคุมการเคลื่อนที่ของเต่า

turtlesim คือ node แสดงผลของเต่า

topic ที่ใช้ :

The screenshot shows a terminal window with two panes. The left pane displays ROS log messages from turtlesim, including rotation goals and their completion. The right pane shows ROS node and topic lists.

```
Dec 16 23:28 mannaja@mannaja:~
```

```
[INFO] [1765902260.043496194] [turtlesim]: Rotation goal received before a previous goal f
[INFO] [1765902260.25238397] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902260.459624056] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902260.651592872] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902260.827789447] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902261.036454151] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902261.275615661] [turtlesim]: Rotation goal completed successfully
[WARN] [1765902261.899640626] [turtlesim]: Rotation goal received before a previous goal f
[INFO] [1765902262.091664263] [turtlesim]: Rotation goal received before a previous goal f
[INFO] [1765902262.284198422] [turtlesim]: Rotation goal received before a previous goal f
[INFO] [1765902262.427941224] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902262.492226184] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902262.683772355] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902262.876127936] [turtlesim]: Rotation goal completed successfully
[INFO] [1765902263.084066277] [turtlesim]: Rotation goal completed successfully
```

```
mannaja@mannaja:~/opt/ros/jazzy/share/nav2_bringup 100x23
```

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

```
(391_web_venv) mannaja@mannaja:~$
```

```
/dock_robot
/drive_on_heading
/follow_gps_waypoints
/follow_path
/follow_waypoints
/navigate_through_poses
/navigate_to_pose
/smooth_path
/spin
/undock_robot
/wait
```

```
(391_web_venv) mannaja@mannaja:~/opt/ros/jazzy/share/nav2_bringup$ ^C
(391_web_venv) mannaja@mannaja:~/opt/ros/jazzy/share/nav2_bringup$ ros2 run turtle_teleop_key
usage: ros2 run [-h] [--prefix PREFIX] package_name executable_name ...
ros2 run: error: the following arguments are required: executable_name, argv
```

```
(391_web_venv) mannaja@mannaja:~/opt/ros/Jazzy/share/nav2_bringup$ ros2 run turtlesim turtle_teleop_k
ey
SSD Reading from keyboard
SSD .....
Use arrow keys to move the turtle.
Use g|b|v|c|d|e|r|t keys to rotate to absolute orientations. 'f' to cancel a rotation.
[q] to quit.
```

/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 สำหรับแสดงผลว่าเต่าอยู่ที่ตำแหน่งที่เท่าไหร่ของจอ