Basic Guide to Working with ROS 2 Humble

1 Introduction

Robot Operating System 2 (ROS 2) Humble is a long-term support (LTS) distribution widely used for robotics research and development. This document provides a concise set of basic commands required to create, build, and run ROS 2 packages, and to work with Gazebo simulation using ROS 2 Humble.

2 Sourcing ROS 2 Humble

Before working with ROS 2, the environment must be sourced in every new terminal.

```
source /opt/ros/humble/setup.bash
```

To verify installation:

```
ros2 --version
```

3 Creating a Workspace

A ROS 2 workspace is required to store and build packages.

```
mkdir -p ~/ros2_ws/src
cd ~/ros2_ws
```

4 Creating a Package

4.1 Python Package

```
cd ~/ros2_ws/src
ros2 pkg create my_pkg --build-type ament_python --dependencies
   rclpy std_msgs
```

4.2 C++ Package

```
cd ~/ros2_ws/src
ros2 pkg create my_pkg --build-type ament_cmake --dependencies
   rclcpp std_msgs
```

5 Installing Dependencies

```
cd ~/ros2_ws
rosdep install --from-paths src --ignore-src -r -y
```

6 Building Packages with Colcon

6.1 Build All Packages

```
cd ~/ros2_ws
colcon build
```

6.2 Build a Specific Package

```
colcon build --packages-select my_pkg
```

7 Sourcing the Workspace

After building, the workspace must be sourced.

```
source install/setup.bash
```

8 Running ROS 2 Nodes

8.1 Run a Python Node

```
ros2 run my_pkg node_name
```

8.2 Run a C++ Node

```
ros2 run my_pkg executable_name
```

9 Launching Files

Launch files are used to start multiple nodes.

```
ros2 launch my_pkg launch_file.launch.py
```

10 ROS 2 Topic Commands

```
ros2 topic list
ros2 topic echo /cmd_vel
ros2 topic info /scan
```

Manual topic publishing:

```
ros2 topic pub /cmd_vel geometry_msgs/msg/Twist "{linear: {x:
   0.3}, angular: {z: 0.5}}"
```

11 Node and Interface Commands

```
ros2 node list
ros2 node info /node_name
ros2 interface list
ros2 interface show geometry_msgs/msg/Twist
```

12 Parameter Commands

```
ros2 param list
ros2 param get /node_name param_name
ros2 param set /node_name param_name value
```

13 Service Commands

```
ros2 service list
ros2 service call /service_name service_type "{data: true}"
```

14 Gazebo with ROS 2 Humble

14.1 Install Gazebo ROS Packages

```
sudo apt install ros-humble-gazebo-ros-pkgs
```

14.2 Launch Gazebo

```
ros2 launch gazebo_ros gazebo.launch.py
```

14.3 Spawn a Robot in Gazebo

```
ros2 run gazebo_ros spawn_entity.py
-entity my_robot
-file model.sdf
-x 0 -y 0 -z 0.2
```

15 RViz Visualization

```
rviz2
```

16 Keyboard Teleoperation

```
ros2 run teleop_twist_keyboard teleop_twist_keyboard
```

17 Common Debugging Commands

17.1 Clean Build

```
rm -rf build install log
colcon build
```

17.2 Fix Missing Packages

```
source install/setup.bash
```

18 Workspace Structure

```
ros2_ws/
          src/
                 my_pkg/
          build/
          install/
          log/
```

19 Conclusion

This document summarizes the essential commands required to construct, build, and run ROS 2 Humble packages, as well as to integrate Gazebo for simulation. These commands form the foundation for further work in robot control, navigation, and simulation using ROS 2.