0.1 ROS PACKAGES FOR URDF, GAZEBO, NAVIGATION, AND COMMUNICATION

Table 1: List of Useful ROS Packages for Robotics Development

Category	Package Name	Description
URDF	urdf	Core package for defining robots in URDF format.
URDF	xacro	XML macro language for simplifying URDF files.
URDF	robot_state_publisher	Publishes the state of the robot to tf.
URDF	joint_state_publisher	Publishes joint states for simulating joint movements.
URDF	kdl_parser	Parses URDF into KDL trees for kinematic calculations.
URDF	srdf	Semantic Robot Description Format for MoveIt!.
Gazebo	gazebo_ros_pkgs	ROS integration with Gazebo.
Gazebo	gazebo_plugins	Plugins for sensors like cameras, lasers, and IMUs.
Gazebo	gazebo_ros_control	Integrates ROS control with Gazebo.
Gazebo	hector_gazebo_plugins	Additional plugins for GPS, sonar, and IMU sensors.
Gazebo	ros_control	Framework for controlling robots in simulation and real hardware.
Gazebo	controller_manager	Manages controllers for joints in Gazebo.
Gazebo	effort_controllers	Effort-based controllers for joints.
Gazebo	position_controllers	Position-based controllers for joints.
Gazebo	velocity_controllers	Velocity-based controllers for joints.
Navigation	move_base	Core package for navigation stack, responsible for global and local path planning.
Navigation	amcl	Adaptive Monte Carlo Localization for 2D pose estimation.
Navigation	gmapping	SLAM algorithm using laser scans.

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Category	Package Name	Description
Navigation	cartographer	Advanced SLAM library supporting 2D and 3D mapping.
Navigation	navigation	Full ROS Navigation stack.
Navigation	global_planner	Global path planner (e.g., A*, Dijkstra).
Navigation	local_planner	Local path planner (e.g., DWA, TEB).
Navigation	teb_local_planner	Timed Elastic Band local planner for dynamic environments.
Navigation	costmap_2d	2D costmap representation for obstacle avoidance.
Navigation	dwa_local_planner	Dynamic Window Approach for local path planning.
Navigation	nav_msgs	Messages related to navigation (e.g., Odometry, Path).
Communication	rospy	Python client library for ROS.
Communication	roscpp	C++ client library for ROS.
Communication	std_msgs	Standard message types (e.g., Float32, String, Bool).
Communication	sensor_msgs	Messages for sensor data (e.g., LaserScan, Image, Imu).
Communication	geometry_msgs	Messages for geometry-related data (e.g., Pose, Twist, Point).
Communication	tf / tf2	Transform library for managing coordinate frames.
Communication	actionlib	Action server/client for long-running tasks.
Communication	message_filters	Synchronizes multiple topics based on timestamps.
Communication	rosserial	Communicate with microcontrollers over serial.
Communication	rosbridge_suite	WebSocket-based communication for web-based interfaces.
Communication	rosapi	Provides REST API access to ROS topics, services, and parameters.

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Category	Package Name	Description
Manipulation	moveit	Motion planning framework for robotic arms.
Manipulation	moveit_core	Core components of MoveIt! (planning, kinematics, etc.).
Manipulation	moveit_ros	ROS integration for MoveIt!.
Manipulation	moveit_commander	Python interface for MoveIt!.
Manipulation	trac_ik	Inverse Kinematics solver that works well with MoveIt!.
Manipulation	moveit_visual_tools	Tools for visualizing motion planning in RViz.
Manipulation	grasp_generator	Generates grasps for robotic manipulators.
Visualization	rviz	3D visualization tool for ROS.
Visualization	rviz_plugin_tutorials	Tutorials for creating custom RViz plugins.
Visualization	rviz_imu_plugin	Plugin for visualizing IMU data in RViz.
Visualization	rviz_satellite	Plugin for visualizing satellite imagery in RViz.
Sensors	laser_geometry	Converts laser scans into point clouds.
Sensors	image_transport	Handles image transport (e.g., compressed images).
Sensors	camera_info_manager	Manages camera calibration information.
Sensors	depth_image_proc	Processes depth images (e.g., from RGB-D cameras).
Sensors	pcl_ros	ROS integration with Point Cloud Library (PCL) for 3D perception.
Sensors	octomap	3D occupancy grid mapping for collision avoidance.
Sensors	rtabmap_ros	Real-Time Appearance-Based Mapping for SLAM.
Sensors	aruco_ros	Detects ArUco markers for augmented reality and localization.
Control	control_toolbox	Provides PID controllers and other control utilities.

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Category	**Package Name**	**Description**
Control	realtime_tools	Tools for real-time control in ROS.
Control	trajectory_msgs	Messages for defining trajectories (e.g., JointTrajectory).
Control	joint_trajectory_controller	Controller for executing joint trajectories.
Control	gazebo_ros_force_system	Applies forces to objects in Gazebo.
Other	dynamic_reconfigure	Allows dynamic reconfiguration of node parameters at runtime.
Other	diagnostic_updater	Monitors the health of ROS nodes and publishes diagnostic messages.
Other	robot_localization	State estimation package that fuses data from multiple sensors.
Other	slam_toolbox	Flexible SLAM solution with support for online and offline mapping.
Other	rosbag	Records and plays back ROS messages for debugging and testing.
Other	rosparam_shortcuts	Simplifies loading parameters from the parameter server.