ENGR 4421:Robotics II

ROS Tutorial: CLI Tools

01/26/2023

Outline

- Preparation
- Config Environment
- Turtlesim
- Nodes
- Topics
- Services
- Parameters
- Actions
- rqt_console
- Launch
- Bag

Installation

- Guide page:

  https://docs.ros.org/en/humble/Installation/Ubuntu-Install-Debians.html

- On Laptop/Desktop:

  ```
  sudo apt install ros-humble-desktop
  ```

- On Raspberry Pi:

  ```
  sudo apt install ros-humble-ros-base
  ```

- Verify installation

  ```
  source /opt/ros/humble/setup.bash
  ros2 run demo_nodes_cpp talker
  ```

Configuring Environment

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Configuring-ROS2-Environment.html

- Source ROS setup file:

  ```
  echo "source /opt/ros/humble/setup.bash" >> ~/.bashrc
  ```

- Domain ID:

  ```
  echo "export ROS_DOMAIN_ID=<your_domain_id>" >> ~/.bashrc
  ```

Using turtlesim and rqt

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Introducing-Turtlesim/Introducing-Turtlesim.html

- Start turtlesim:
  ```
  ros2 run turtlesim turtlesim_node
  ```

- Control the turtle:
  ```
  ros2 run turtlesim turtle_teleop_key
  ```

Understanding Nodes

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Understanding-ROS2-Nodes/Understanding-ROS2-Nodes.html

- List nodes:
  `ros2 node list`

- Node info:
  `ros2 node info <node_name>`

- Use `rqt_graph` to visualize nodes.

Understanding Topics

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Understanding-ROS2-Topics/Understanding-ROS2-Topics.html

- List topics:
  ```
  ros2 topic list
  ```

- Listen to topics:
  ```
  ros2 topic echo <topic_name>
  ```

- Publish message using a topic
  ```
  ros2 topic pub <topic_name> <msg_type> '<args>'
  ```

- Use `rqt_graph` to visualize topics.

Understanding Services

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Understanding-ROS2-Services/Understanding-ROS2-Services.html

- List services:
  ```
  ros2 service list
  ```

- Request a service:
  ```
  ros2 service call <service_name> <service_type> <arguments>
  ```

- Publish message using a topic
  ```
  ros2 topic pub <topic_name> <msg_type> '<args>'
  ```

- Use `rqt` to visualize and call services.

Understanding Parameters

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Understanding-ROS2-Parameters/Understanding-ROS2-Parameters.html

- List parameters:
  ```
  ros2 param list
  ```

- Get a parameter value:
  ```
  ros2 param get <node_name> <parameter_name>
  ```

- Set a parameter value:
  ```
  ros2 param set <node_name> <parameter_name> <value>
  ```

- Save parameters to a config file
  ```
  ros2 param dump <node_name> > <config_file>
  ```

- Load parameters from a config file
  ```
  ros2 param load <node_name> <config_file>
  ```

Understanding Actions

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Understanding-ROS2-Actions/Understanding-ROS2-Actions.html

- List actions:
  ```
  ros2 action list
  ```

- Send a goal to an action server:
  ```
  ros2 action send_goal <action_name> <action_type> <values>
  ```

Using `rqt_console` to view logs

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Using-Rqt-Console/Using-Rqt-Console.html

Launching Nodes

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Launching-Multiple-Nodes/Launching-Multiple-Nodes.html

- Using a launch file:

  ```
  ros2 launch <package_name> <launch_file>
  ```

Recording and Playing Back Data

- Tutorial page:

  https://docs.ros.org/en/humble/Tutorials/Beginner-CLI-Tools/Recording-And-Playing-Back-Data/Recording-And-Playing-Back-Data.html

- Record a topic:

  ```
  ros2 bag record <topic_name>
  ```

- Play back a topic:

  ```
  ros2 bag play <bag_file>
  ```