Introduction to the Kinova Gen3 Lite arm

Robotics instructional lab #1

Spring 2022

In this lab, we will get to know the Kinova Gen3 Lite robotic arm. Some properties can be seen in the enclosed datasheet along with some diagrams.

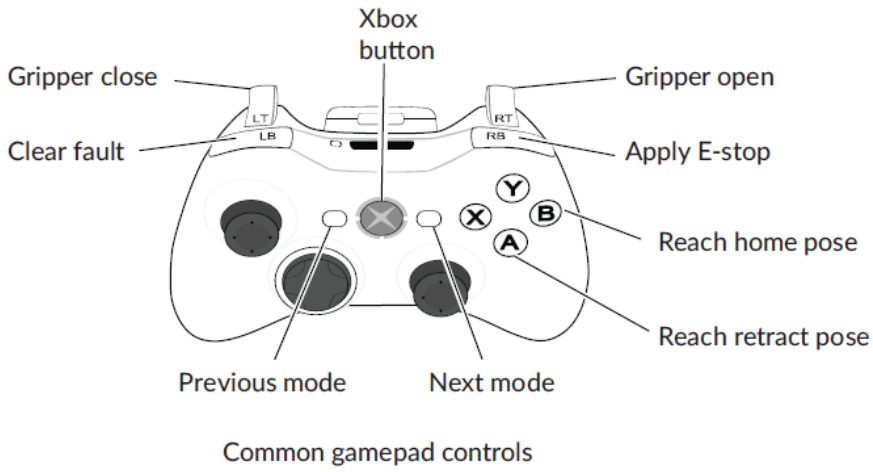

Figure 1: XBox gamepad common commands.

The robot comes with an XBox remote for manual manipulation with common commands seen in Figure 1. The remote has several modes that can be changes using the previous and next mode buttons. Two of the modes control either the linear or angular motion of the gripper as seen in Figures 2-3. Ignore other modes.

1 Prerequisites

Read this guide and the robot datasheet.

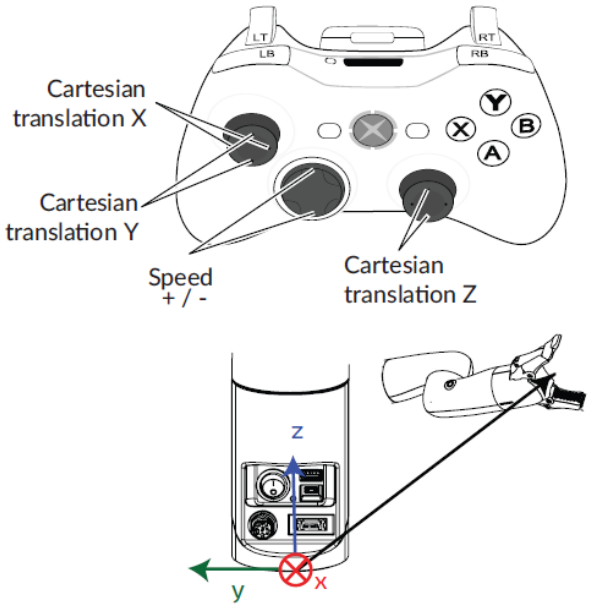

Figure 2: Linear control mode.

2 Lab instructions

When moving the robot, keep your finger on the E-Stop button of the remote control for emergency stops.

1. Run script **check_connection_lab1.py** from the terminal to check successful connection to the robot.
2. **Graphical User Interface (GUI):** The instructor will show you how to connect and use the GUI. Using the GUI, write down the following:
   - Joint angles at home and retract position.
   - Actuator temperature, current, voltage and torques. Observe the changes when gently pushing the arm.
3. **Remote control:** Each student should experience the use of the remote and control the robot with the two modes.
4. **Data recording during manual control:** In this part, you will record motion while moving the arm with the remote. Do the following:
   - Run the script **lab_01.py**.
   - After connecting the remote, hit *Enter*.

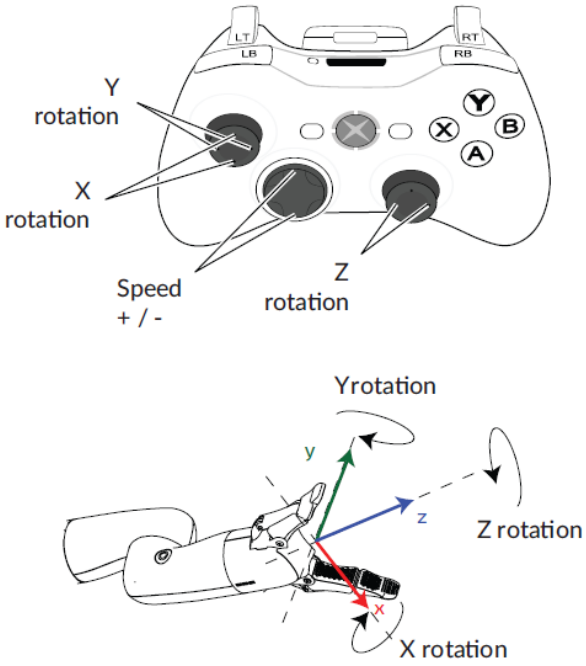

Figure 3: Angular control mode.

- Press 's' to start recording.
- Press 'q' to finish recording.
- The recordings will be stored in **./data/lab-01+**time**** where **time** is the date and hour of the recording. The file includes tow lists: 1) is an $N \times 6$ array of joint readings along the path, and 2) is an $N \times 3$ array of gripper position relative to the base.
- Repeat the above until obtaining five paths of at least 30 seconds long each.

5. **Move the robot using code:** We will now move the robot using commands from a Python script. The script sends commands to the robot actuators. One can send either desired joint angles or gripper pose.

   - Run script **lab_01_single_action.py**.
   - Press 'H' to move to *home* configuration.
   - Press 'C' to move the robot with a command in the gripper space.
   - Press 'A' to move the robot with a command in the configuration (joint) space.

3 Report requirements

You are required to analyse the recorded paths. To ease the analysis, we have included a script called **lab_01_student.py** which contains functions for reading dataset files of *Pickle type*. The lab report should include the following:

1. Describe the process of the lab.
2. A plot (each for every recorded path) that shows the gripper position (curve for each coordinate) along motion with respect to time.
3. A plot (each for every recorded path) that shows joint angles (curve for each joint) along motion with respect to time.
4. 3D scatter plot that shows the work space of the gripper. Use data from all paths.

Assume sample frequency of 30Hz. All angle values should be expressed in **degrees**.

Plots should be acquired in Python (not Excel).