AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
MECHATRONICS ENGINEERING DEPARTMENT

Spring 2023

MCT 344: Industrial Robotics

Project Milestone 2 Description:

With the aid of packages, scripts we did together and lab recordings, each team should submit a working package named **`open_manipulator_custom_kinematics`** with 2 nodes, **note: all of the following need the robot to be spawned in Gazebo:**

1. The first node should be named **`fkine_node`**, this node has 1 subscriber and 1 publisher, the subscriber subscribes to a topic named **/joint_states** of type **sensor_msgs/JointState** to fetch from the joint angles of the robot, after fetching the 4 joint angles, these angles should be used to calculate the forward kinematics using DH parameters, the output after DH calculation will be a 4x4 transformation matrix, each team should then extract the 6 DoF variables *[x, y, z, roll, pitch, yaw]* from the resulting matrix and pack them into **std_msgs/Float32MultiArray** message to published on topic of name **`/robot_pose`**
You should use the GUI controller to control your robot and verify the output of your forward kinematics node with the true values displayed in the GUI.

2. The second node should be named **`ikine_node`**, this node has 1 subscriber and 3 publishers, the subscriber subscribes to a topic with name **/target_goal** of type **std_msgs/Float32MultiArray** that should hold 3 values in the data array member which are *[target_x, target_y, target_z], these target_x, target_y, and target_z* correspond to a robot target goal in 3D, these should be used to calculate inverse kinematics based on the geometric method discussed in the tutorials. For ease of implementation, you may assume that joint 4 is fixed and is always having zero angle, by this you will assumably join links 3, 4, and end effector link into one tall link. After calculation of the required joint angles from inverse kinematics, you are required to move the robot on gazebo accordingly by publishing to the 3 joint angles topics **/joint1_position/command**, **/joint2_position/command**, **/joint3_position/command**

REQUIRED TO SUBMIT (all in a combined single PDF file per team, only one person uploads here):

1. Screenshots of clean and commented written codes of the ROS node(s).

2. Screenshots for the outputs with terminal appearing at all commands.
a. screenshots of topic echoing of calculated pose after running forward kinematics nodes
b. screenshots for the robot moved inside gazebo after running your inverse kinematics node
c. screenshots of moving the robot using GUI controller and verifying your calculations

3. A video link for the project Implementation must be uploaded with a clear explanation of all the steps.