Jackal Mobile Robot

The goal is to design desired trajectories and plan the motion of a wheeled differential drive robot, Clearpath's Jackal, (a) in a simulation environment and (b) in real-world conditions. The simulation environment will be created using the software packages ROS, RViz, and/or Gazebo. The tasks for this project are as follows:

- Write a program (node) that moves the wheeled robot with arbitrary desired linear velocity, u_d, and angular velocity, ω_d, expressed with respect to the body-fixed frame. Store (using the rosbag package) the trajectories of the displacements/rotations and velocities (linear and angular) for the values provided in the table.

Velocity $[u_d, \omega_d]^T$	Duration
$[0\ m/sec, -15\ °/sec]^T$	10 sec
$[0.1\ m/sec, -10\ °/sec]^T$	15 sec

- The initial position, (x_0, y_0), and orientation, θ_0, of the robot are given. Design three different trajectories: The first trajectory will describe the robot's rotation so that it "faces" a given final position, (x_f, y_f). Then, the second trajectory will describe the robot's linear motion so that it reaches the given final position. Once the robot reaches the final position, the third trajectory will describe its rotation to acquire a given final orientation, θ_f.

Method/Parameter	Value
Γραμμικές συν. με παραβολικά τμήματα	AM = 5351
Αρχική θέση και Προσανατολισμός	$q_0 = [x_0, y_0, \theta_0]^T = [0\ m, 0m, 0\ rad]^T$
Τελική θέση και Προσανατολισμός	$q_0 = [x_f, y_f, \theta_f]^T$ = [round(AM/1000) m, round(AM/1000) m, (AM/3500) rad]^T
Μέγιστη Γραμμική Ταχύτητα	0.2 m/sec
Μέγιστη Γωνιακή Ταχύτητα	30 °/sec

- Write a program (node) that implements the trajectories designed in the previous question. In the code you write, the robot's motion will be implemented by directly giving velocity commands to the robot through the */cmd_vel topic.

Rrbot Manipulator Robot

The goal is to program the motion of a robotic arm in a simulation environment, so that it moves according to predesigned trajectories. The simulation environment will be created using the software packages ROS, RViz, and/or Gazebo. The tasks for this project are as follows:

- Write a program (node) that rotates the joints of the robotic arm, q_1 and q_2, to desired angles. Store (using the rosbag package) diagrams of the joint variables' trajectories, as well as their velocities, for the values provided in the table.

Μεταβλητή άρθρωσης	Starting Angle	Final Desired Angle
q_1	0°	25°
q_2	0°	-30°

- Design trajectories for the joints, such that they simultaneously start from the initial angles and stop at some final desired angles. Select the movement duration, t_f, to be the same for both joints, ensuring that the angular velocity of each joint does not exceed its maximum value. For the method of linear functions with parabolic segments, assume that tb is equal to 10% of t_f.

Method/Parameter	Value
Κυβικά Πολυώνυμα	AM = 5351
Αρχικές γωνίες των αρθρώσεων	$q_0 = [q_{1,0}, q_{2,0}]^T = [0^0, 0^0]^T$
Τελικές γωνίες των αρθρώσεων	$q_0 = [q_{1,f}, q_{2,f}]^T = [\text{round}(AM/80)^o, \text{round}(AM/120)^o]^T$
Μέγιστη γωνιακή ταχύτητα της 1	$q_{1,max}$ = 9 °/sec
Μέγιστη γωνιακή ταχύτητα της 2	$q_{2,max}$ = 11 °/sec