Assignment 1: Forward Kinematics of a 2-D SCARA Robot
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1. Introduction

This assignment implements the forward kinematics of a simple 2-D SCARA robot with two rotational joints. A JavaFX application is developed to visualize the robot arm pose based on user-defined joint angles and link lengths.

2. Forward Kinematics Model

The robot consists of two planar links with lengths a_1 and a_2, and two rotational joints with angles q_1 and q_2. The first joint is fixed at the base. The positions of the second joint and end-effector are computed using 2-D homogeneous transformation matrices. The overall transformation from the base to the end-effector is obtained by multiplying the individual joint transformations.

3. System Design

The system architecture is illustrated using a UML class diagram.
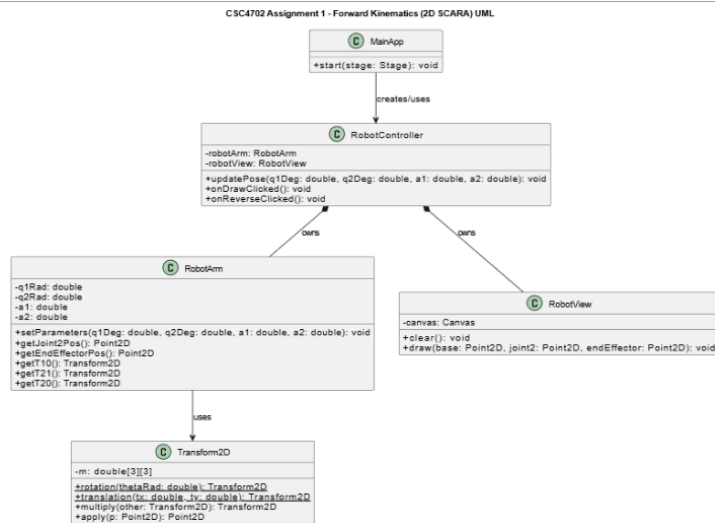
4. Implementation and Results

The JavaFX application allows users to input joint angles and link lengths and dynamically displays the robot arm pose. The robot is drawn using line segments for links and points for joints. A reverse motion feature animates the robot arm back to its initial configuration. The simulation produces correct robot poses for different input values.
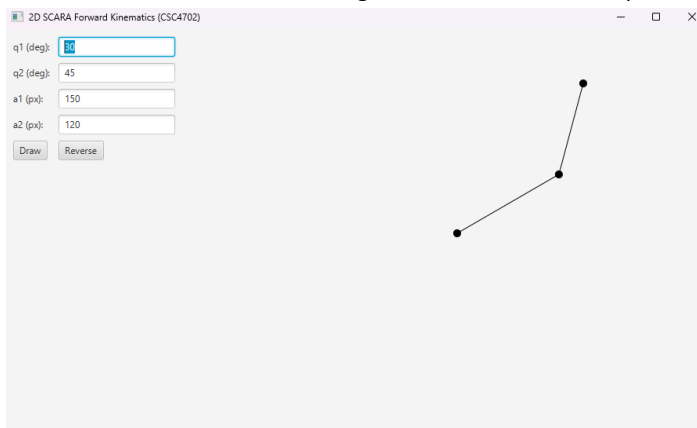
5. Conclusion

The assignment successfully demonstrates the forward kinematics of a 2-D SCARA robot using homogeneous transformation matrices. The JavaFX visualization confirms the correctness of the kinematic model and provides an intuitive understanding of robotic motion.