FINAL PROJECT

POSITION CONTROL OF ROBOTIC ARM USING INVERSE KINEMATICS

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ABSTRACT

The robot arm is an open-chain manipulator-type robot that has revolute or prismatic joints. The degree of freedom of a robot arm depends on the number of joints it has. Due to the large number of degrees of freedom, kinematic analysis of a robot arm is required. Robot kinematics are divided into two categories, namely, forward kinematics and inverse kinematics. Forward kinematics is used to find the final position, while inverse kinematics is used to find the angle of each joint.

This final project aims to obtain the kinematics of a 6-DOF robot arm where the movement of the robot will be controlled by a computer using the principle of inverse kinematics.

The inverse kinematics will be obtained using a homogeneous transformation, where the robot arm is first defined using the Denavit-Hartenberg parameters. Once the Denavit-Hartenberg parameters are obtained, the forward kinematics can be found, which will then be used to find the inverse kinematic equations of the robot arm.

The robotic arm will be made using aluminium, with a Nema 17 stepper motor and a DS3240 servo motor, as well as an MG996r servo motor to move the gripper. The robotic arm will be controlled using a Raspberry Pi 4 Model B. To increase torque, a pulley system is used, with a ratio of 1:4. The sensor used is the LJ12A3-4-Z/BY proximity sensor with an additional PC817 optocoupler as a signal transfer. 2 power supplies are needed to run this robotic arm, namely a 24V power supply used for the stepper motor and a 5V power supply used for the servo motor.

From the results of the experiments that have been conducted, the robotic arm can perform tasks such as picking up and moving objects. However, there are still errors in orientation caused by the presence of more than one inverse kinematic solution.

keywords: Robotic Arm, Homogenous Transform Matrix, Forward Kinematic, Inverse Kinematic.