

Robot Manipulators and Automation

AUTO4507

Lab Assignment 3 –Group– Serial Robot Points: (1+2+1)+(3+3) = 10

Make yourself familiar with the UR5 robot documentation and the interfacing via Ethernet.

Experiment 1 – Moving in Space

1. 1 Square

(a) Joint Space

Write a program that moves the robot in a sequence to the 4 corner points of a **square** of size 20cm. Let the robot stop for 1 second after reaching each position.

(b) Cartesian Space

Repeat the same experiment, but let the arm move along a straight line

1. 2 Cube

(a) Joint Space

Write a program that moves the robot in a sequence to the 8 corner points of a **cube** of size 20cm. Let the robot stop for 1 second after reaching each position.

(b) Cartesian Space

Repeat the same experiment, but let the arm move along a straight line

1. 3 Circle

Write a program that moves the robot gripper along a circle of diameter 20cm.

Experiment 2 – Vision System

Start with the robot arm resting above the table with the camera looking down.

Using OpenCV in Python or C++, solve the following tasks.

2.1 Classification

Identify all objects on the table and classify them as either triangle, square, (half-) circle or star shapes using OpenCV function: `approxPolyDP`

See link for shape detection:

<https://stackoverflow.com/questions/11424002/how-to-detect-simple-geometric-shapes-using-opencv>

Print out each object's type.



2.2 Calculation

For each detected object:

- Calculate and print the global coordinates of its 2D center-point.

- Move the robot arm down to touch the object.