

FMH606 Master's Thesis

Title: Real time control of robotic arm manipulators

USN supervisor: Roshan Sharma (USN)

Task background:

Robotic arm manipulators are widely used in industries for various applications. They are used in automotive, aerospace, electronic/electrical industries, shipping and trade etc. (just to name a few), for example, for performing repetitive tasks like those involved in an assembly line. USN has recently purchased several units of a ReactorX 150 robotic arm manipulators from Trossen Robotics. These robotic arms are planned to be used in teaching and research activities here at USN. The ReactorX 150 offers 5 degrees of freedom and a full 360 degree of rotation. At the heart of the ReactorX150 is the Robotis DYNAMIXEL X-Series smart servo motors and DYNAMIXEL U2D2 which enables easy access to Dynamixel software development kit. Figure 1 shows the ReactorX150 robotic arm manipulator.



Figure 1: ReactorX 150 robotic arm manipulator

Aim:

It is of interest to use this robotic arm in a MATLAB/Simulink platform for forming various tasks like position/trajectory control, direct/inverse kinematics, some advanced model based control by making use of robot dynamics and advanced observer/estimator design. Furthermore collaborative tasks involving interaction of two or more ReactorX150 robot arm manipulators is also considered to be one of goals of this project.

Task description:

The following are the main tasks:

- a) Set up, configure and test the ReactorX 150 robotic arm to be used with Simulink/MATLAB for various functionalities. In this task you should create necessary communication interfaces between the physical robotic arm and Simulink/MATLAB.

- b) Use the robotic arm for direct and inverse kinematics. For the inverse kinematic, the end-effector trajectory can either be (i) specified using polynomials, or (ii) it can also be created by simply moving the robot arm manually by hand along the desired trajectory.
- c) Use the robotic arm for pick and place operations. For this the gripper mechanism should be used.
- d) Using at least two or more ReactorX 150 robot arms, perform collaborative or interactive tasks. In this task, you may need to use additional hardware/software support.
- e) If time permits, interface a camera (for e.g. raspberry pi camera) to the robot arm and perform some tasks involving computer vision like classifying/separating different coloured objects.
- f) Document the work in a report. Presentation of the work.

Student category: Reserved

Reserved for Mohammad Saifuddin Chowdhury.

The task is suitable for online students (not present at the campus): No

Practical arrangements:

ReactorX 150 robotic arm manipulators will be provided to the student.

Signatures:

Supervisor (date and signature):



25.01.2022

Students (date and signature):

