Assignment 2 – Industrial Robot Programming

Introduction

The task of programming an industrial robot involves new concepts and issues when compared with conventional software programming.

In robot programming a major concern is the movement on physical equipment, therefore special attention has to be paid to the movement of the robot.

Offline robot programming offers the possibility to visualize in a 3D environment the behavior of an industrial robot for a given code. Therefore, it is possible to optimize routines, ensure its robustness and verify that the routines are safe for operators and other pieces of equipment. Then the code can be deployed on the physical industrial robot. For this assignment Robot Studio will be used as the offline programming environment.

Industrial robots are programmed with high level programming languages, which are specific to each manufacturer. Nevertheless, it is common to find similar commands across them. For this ABB robots will be programmed by using RAPID language.

For this assignment use the RAPID manuals provided in Moodle, the presentation file contains the most common buttons you need to use in Robot Studio and template files are given to start to work on each of the tasks.

Objective

After this assignment you should understand the main terms and concepts involved in the task of programming an industrial robot.

Get practice with high level industrial robot programming language, learn the main commands and instructions.

Interact with a real industrial robot and its components. Learn the basic steps to deploy code on it.

Environment

1. Robot Studio to emulate and practice offline robot programming.

2. RAPID language for programming ABB industrial robots

3. Robotic cell containing: ABB robot IRB 140

Tasks

The assignment consists on two tasks which are described next. Please consult and check the RAPID manuals provided in moodle.

Task 1. Welding routine

For this task you will program a 6 DoF ABB robot. Choose any model that accomplish this task. A recommended model is the IRB 1520 robotic arc welder. The physical structure of this manipulator gives it positioning flexibility which is required for welding tasks.

a) Generate a program that follows the external and the internal part of the given piece as illustrated in Figure 1.
b) Make your robot wait for 3 seconds. Then assume another workpiece is placed on top of the workpiece that the robot already processed. Repeat the welding path on the new workpiece.

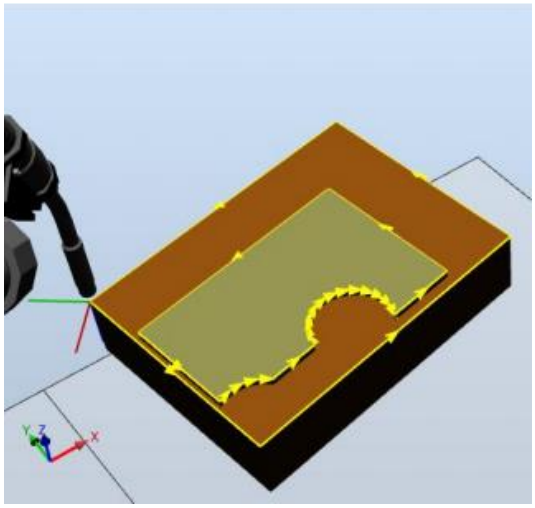

Figure 1. Welding path

Considerations

Be sure that the torch comes from top when it starts the welding at the paths.

Be sure the torch leaves vertically when it finishes welding each of the paths.

Task 2: Pick and place

Your task is to program one robot, the ABB IRB 140. First create and test your code offline (Robot Studio) and later on the real equipment. For deploying your code in the real equipment, a supervisor will help you to do it. Reservation system is available in Moodle

The template you are given contains the workstation and its components that you will face in reality. This workstation is composed of conveyors and two IRB 140 which are placed upside down, see Figure 2.

Program a simple Pick & Place routine for the robot 1. Your robot should pick the red workpiece shown in the Figure 3. It should move it through couple of arbitrary via points and then place it in the green basket located under the robot.

The Pick & Place routine has the next requirements:

1. Create your pick and place targets
2. Define pre-pick/pre-place targets on top of the pick/place targets
3. Move with free joint movement between via points and pre-pick, pre-place targets, speed of V500
4. Move with linear movements between pre-pick/pre-place and the actual pick and place targets with speed of V50

5. After opening/closing the gripper wait for a fraction of a second before you execute the next robot movement

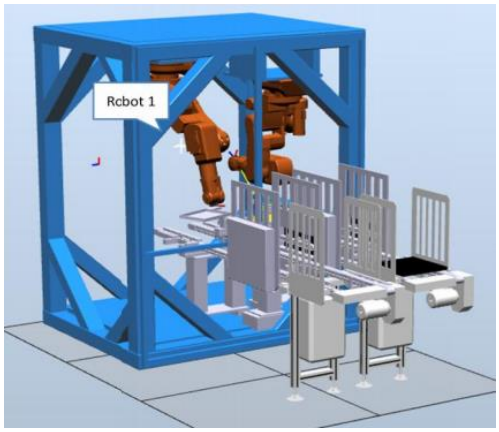

Figure 2. Laboratory workstation

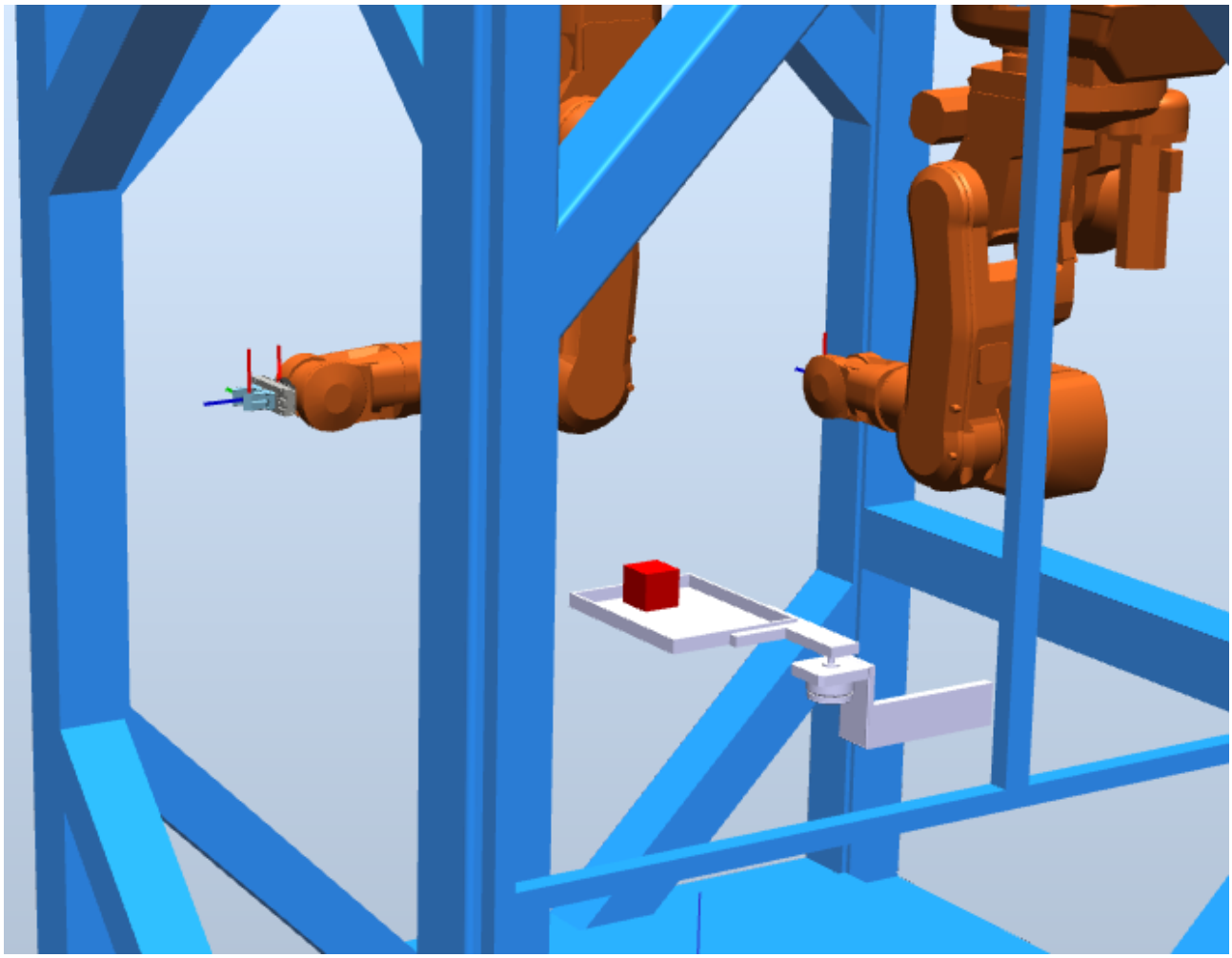

Figure 3. Piece to Pick & Place

Considerations:

Be sure your code does not move the robot close to other components, in order to avoid collisions. This is because the code will actually be deployed on real equipment.

DELIVERY FORM

Work in groups of 3 persons.

For each of the tasks save your systems as Pack and Go files, create your code in an organized way and comment it properly (this will be considered for grading), create a pdf report mentioning the considerations you did, features of your code, etc. , be sure to avoid collisions with the manipulator.

For the last task, it is necessary that each group book a day for making a demo of their code in the physical robot. Booking system is available in moodle.