TEST PROJECT – ROBOT SYSTEMS INTEGRATION

Designed by:
FANUC

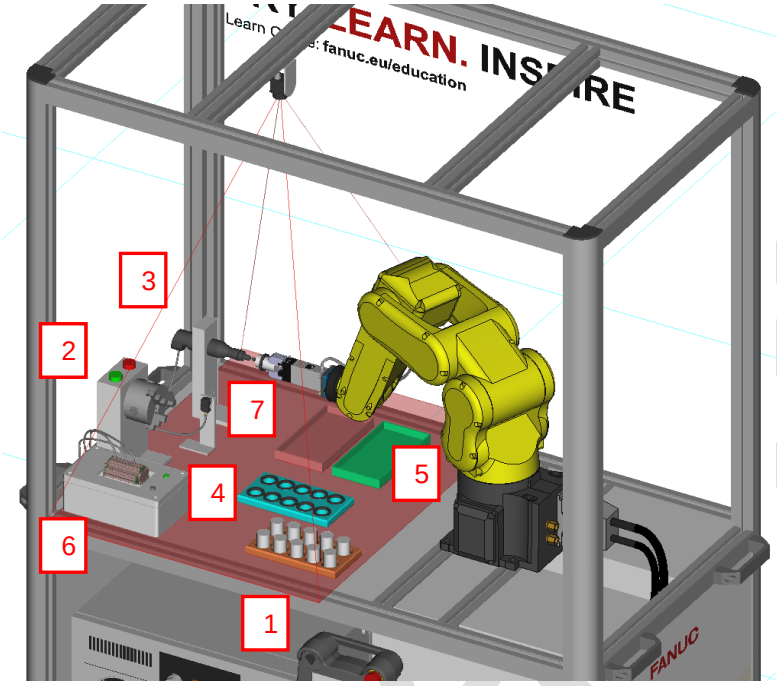
Contents

1. INTRODUCTION TO TEST PROJECT

1.1. COMPETITION CELL

For each Competition the cell will be modified to present a different set of challenges. The Test Project should be presented to the Competitors in the form of a project specification from an Industrial Customer. In this case it is to process raw widgets through a machining, deburring, assembly and inspection process.

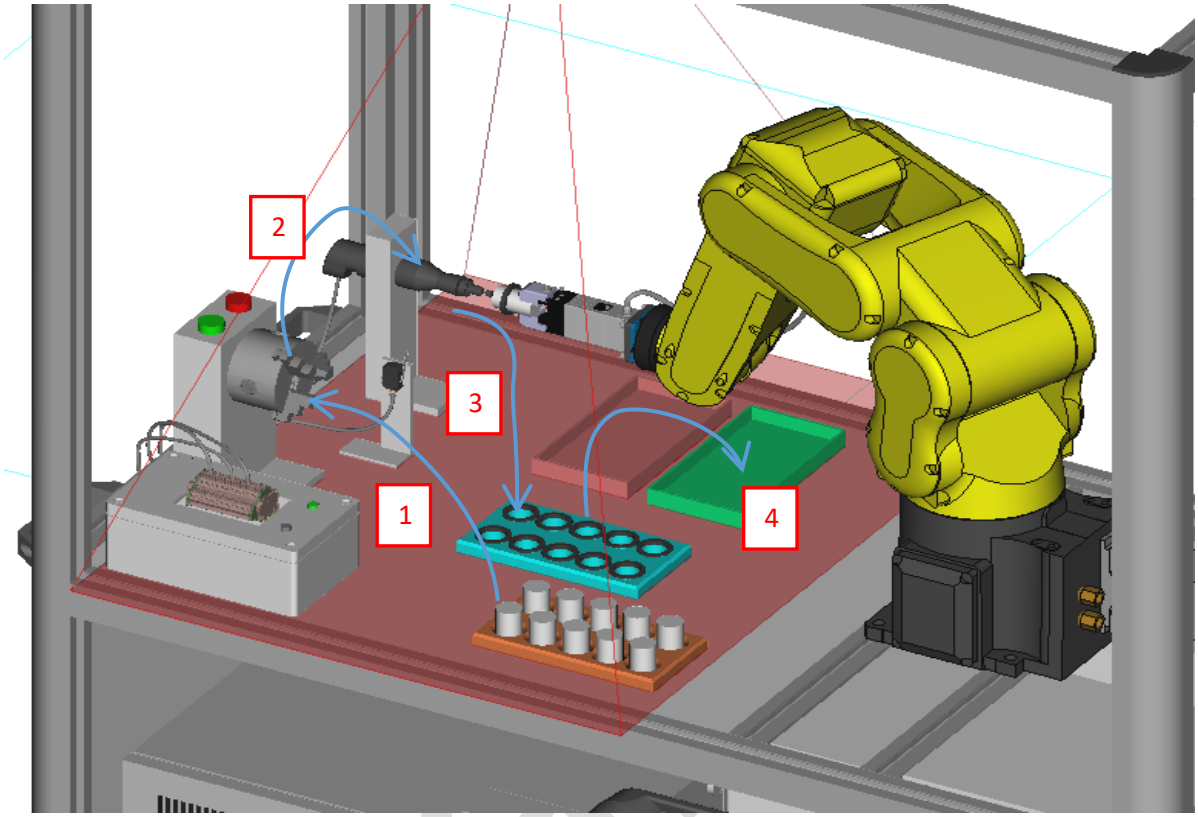
A representative example is shown below.



1	Input Tray – with 10 plastic cylinders loaded into it ready for processing. Note that Input Tray has holes to accurately locate cylinders. (See Task Extension)
2	Machine Chucks – with LEDs showing status
3	Deburring Tool – low power electrical tool
4	Assembly Tray – loaded with 10 plastic rings which are push-fit onto the cylinder
5	Output Trays – no location holes – simple open trays. Green for good parts, Red for reject parts
6	I/O connection terminal strip – pre-wired into controller but not into sensors/LEDs
7	Sensor Switch

1.2. BASIC CHALLENGE

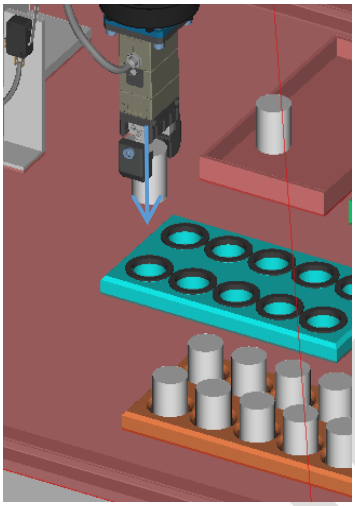
The Basic Challenge will be to set up the cell to run as shown below:



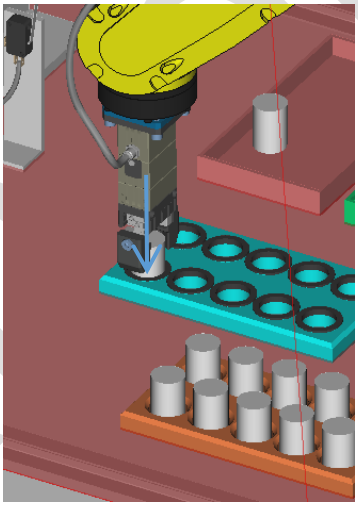
1	Pick part from Input Tray and insert into Chuck - Wait for specified machining time
2	Transfer part from Chuck to Deburring Tool. Rotate part 360° around tool to simulate deburring – tool should spin up / spin down with suitable timing
3	From Deburring tool move part to Assembly Station – press-fit ring onto cylinder
4	Assembly Tray – loaded with 10 plastic rings which are push-fit onto the cylinder
5	Transfer to Output Tray

1.3. DETAILS OF ASSEMBLY OPERATION

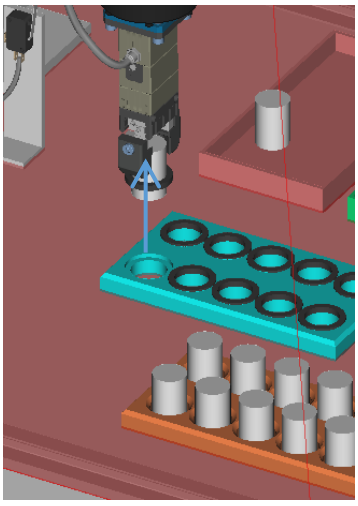
1) Approach Assembly Tray from Deburring Tool



2) Move down into Assembly Tray to insert Cylinder into Ring



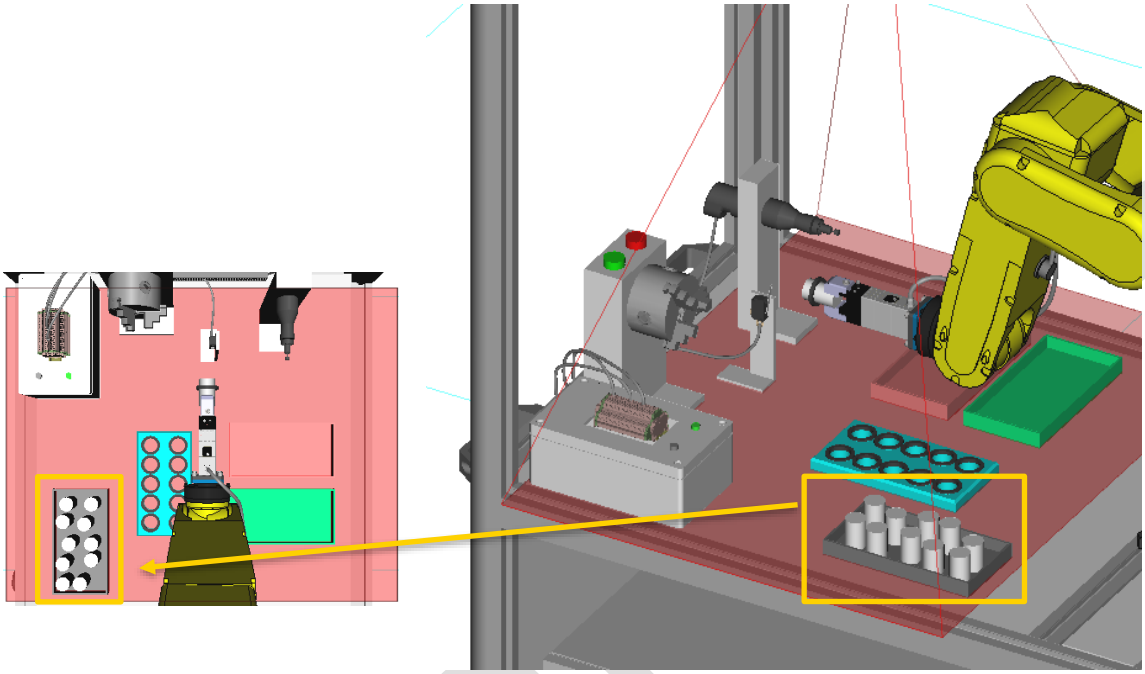
3) Move away from Assembly Tray with combined Cylinder and Ring



2. EXTENSION TASK 1 – IRVISION PART LOCATION

In order to be able to challenge the competitors to their limits – to be able to differentiate between them, extension tasks are foreseen – additional tasks to be completed after the basic task has been achieved.

First Extension Task is to use iRVision for Parts Input



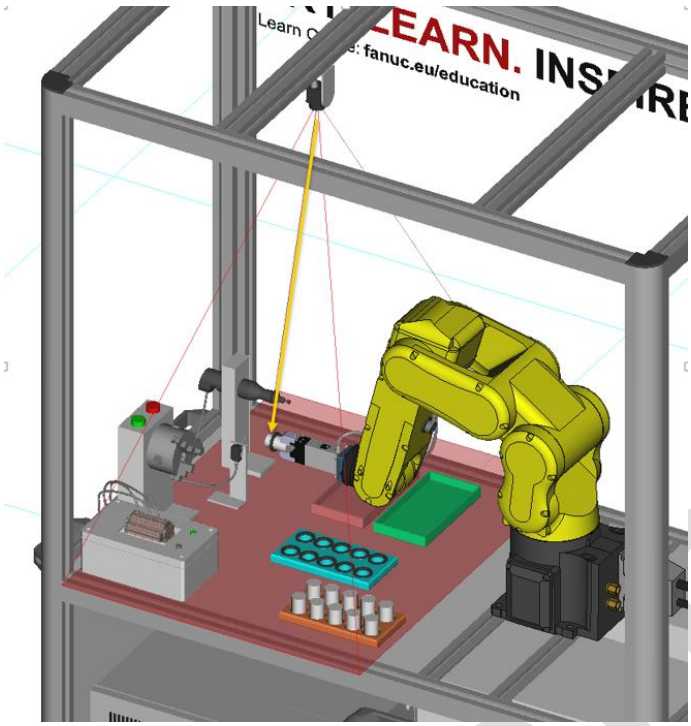
The original Part input tray has fixed locations for the parts.
This was common practice in industry but is an expensive way to present the parts.

The more state-of-the-art method is to use simple parts tray without locations and use Vision to locate the parts before picking.

The FANUC education cell comes with pre-calibrated iRVision 2D camera system installed so competitors can use iRVision to pick the parts from the tray

3. EXTENSION TASK 2 – IRVISION PART INSPECTION

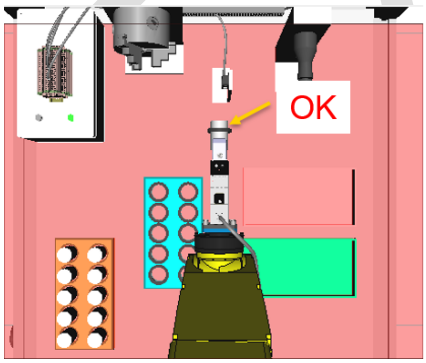
Second Extension Task is to use iRVision for Parts Inspection:

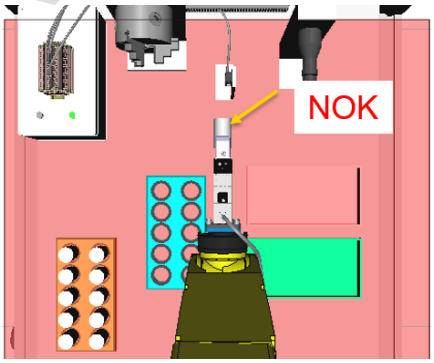


After assembly, the part is presented to the camera as shown above.

Then the camera can check for the presence of the ring – and check OK or NOK.

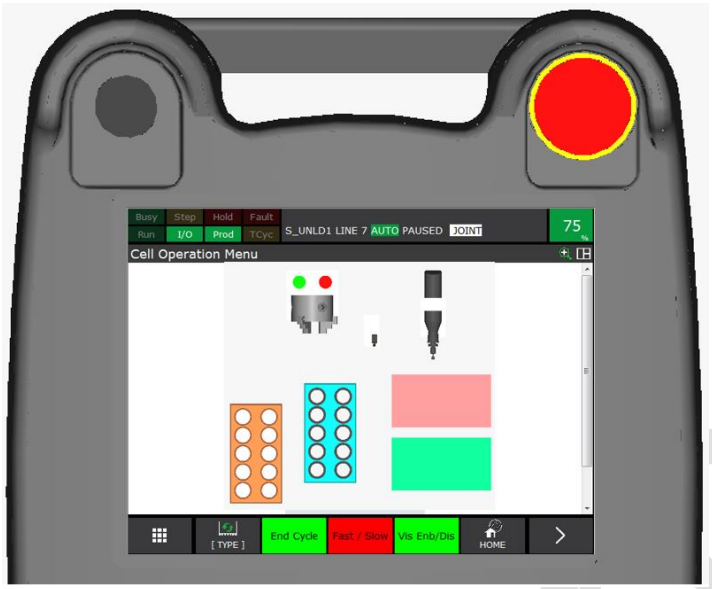
Depending of the result of the inspection the parts should be placed in the GREEN (OK) or RED (NOK) output trays.





4. EXTENSION TASK 3 – IHMI USER INTERFACE

The basic sequence can be executed without any special user interface, but it is common industrial practice to create a custom user interface showing the actual layout of the cell and the progress of parts through the cell, such as shown below:



This user interface should be dynamic – updating as the parts are moved through the cell and should have some command buttons as appropriate for the function of the cell.

5. WORLDSKILLS STANDARDS SPECIFICATION ANALYSIS

The table below shows how the Example Competition relates to the WSSS for this skill

WSSS SECTION		EXAMPLE TEST PROJECT IMPLEMENTATION
01	Work organization and management	As a 2-person team, the competitors must work together and separately. The daily planning should give them some guidance on which tasks to execute in parallel, but the competitors must organize themselves efficiently in order to be successful, and to be able to complete the Extension Tasks which will eventually distinguish between competent and excellent performances
02	Communication and interpersonal skills	
03	Layout and design	Competitors are provided with a PC with FANUC Roboguide simulation system pre-loaded on it. They will also be given CAD files of each component of the Cell- Chucks, Trays, etc. and they should decide layout themselves. They can use the additional features of Roboguide such as cable simulation and modelling to add additional detail / realism to the cell
04	Installation and connectivity	After deciding layout and completing basic mechanical unit integration, competitors can fix peripheral components directly onto the base panel. They must also decide how to control electrical inputs & outputs, make electrical connections (using push-in terminals – no need for soldering) and do I/O configuration
05	Automation and programming	Basic programming task is quite simple, transferring parts from input tray via chuck and deburring tool to assembly station and then to output tray, but to distinguish between competence and excellence there are several extension tasks available: • Use a more sophisticated sequence to feed the machines (chucks) in parallel use to increase productivity. • Use iRVision instead of part locators for more flexible production • Use iRVision or Sensor Switch for Part Checking Create a User interface using HTML and graphics
06	Commissioning, maintenance and troubleshooting	Maintenance challenges can be set for the robot itself, but also for the application – i.e. removing ring from the assembly tray and checking for appropriate response from the system
07	Documentation, briefing and reporting	Documentation suitable for handover to the customer should be created. For example: • User Interface Description (using images from Roboguide and the User I/F to be as realistic / graphic as possible) • Program Listing • Robot Setup Description (Registers, I/O etc.) • List of relevant manuals

6. DAILY SCHEDULE

DAY	AM/PM	PARALLEL ACTIVITIES (MULTIPLE TEAM MEMBERS)		DURATION
1	AM	Competitors arrive All competitor assembly organized by Worldskills		
	PM	Introduction and explanation of task – including safety reminder		20 mins
		Mechanical assembly of robot + gripper	Design of cell layout using Roboguide	3 hours
2	AM	Introduction and explanation of task – including safety reminder		20 mins
		Mechanical & electrical installation of peripheral equipment	Off-line programming of sub-programs	3 hours
	PM	Introduction and explanation of task – including safety reminder		20 mins
		Installation of off-line programs/ programming of basic task	Off-line programming of extension task	3 hours
3	AM	Introduction and explanation of task – including safety reminder		20 mins
		Installation of off-line programs/ programming of extension task	Off-line programming of User Interface	3 hours
	PM	Introduction and explanation of task – including safety reminder		20 mins
		Installation of user interface/test run of complete system	Start preparation of user Documentation	3 hours
4	AM	Introduction and explanation of task – including safety reminder		20 mins
		Fine tuning and proving of system. Maintenance testing (Fault Handling) Optional extension task.	Finalize User Documentation and Simulation	3 hours
	PM	Introduction and explanation of task – including safety reminder		20 mins
		Final demonstration of running system, including extension tasks if accomplished – in form of acceptance test at Customer	Presentation of User Documentation and Simulation – in form of handover to Customer	1 hour
		TOTAL		21 hours