



THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

INDUSTRIAL CENTRE
工業中心

Control and Automation IC2122 Robotics Lab with VREP

Instructor: Louis Wong

Industrial Centre

The Hong Kong Polytechnic University

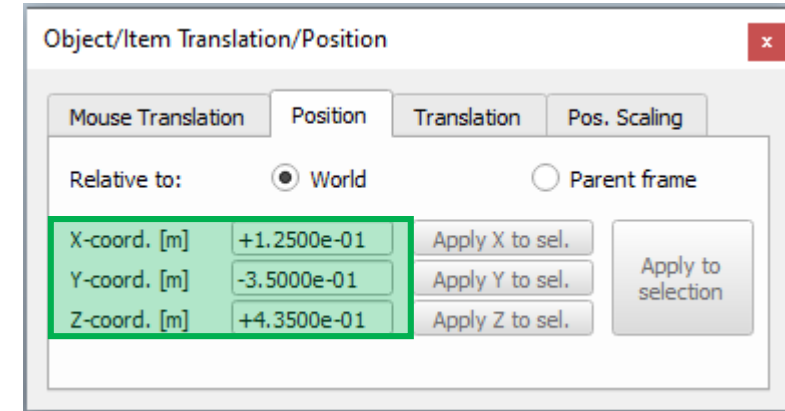
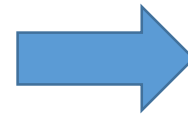
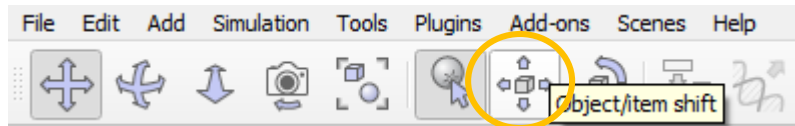
V-REP Tools

- Object Position:

1. Select the object

2. Click

3. Position: X, Y, Z

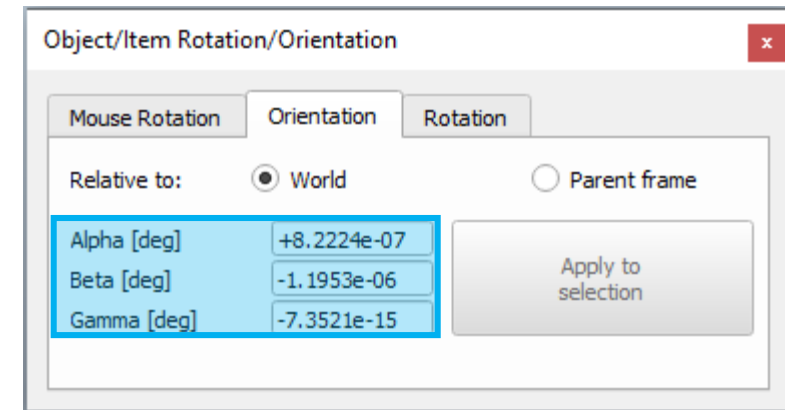
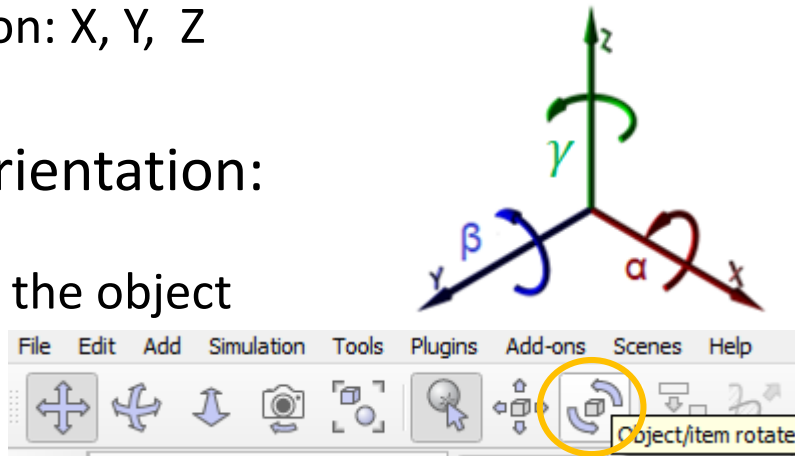


- Object Orientation:

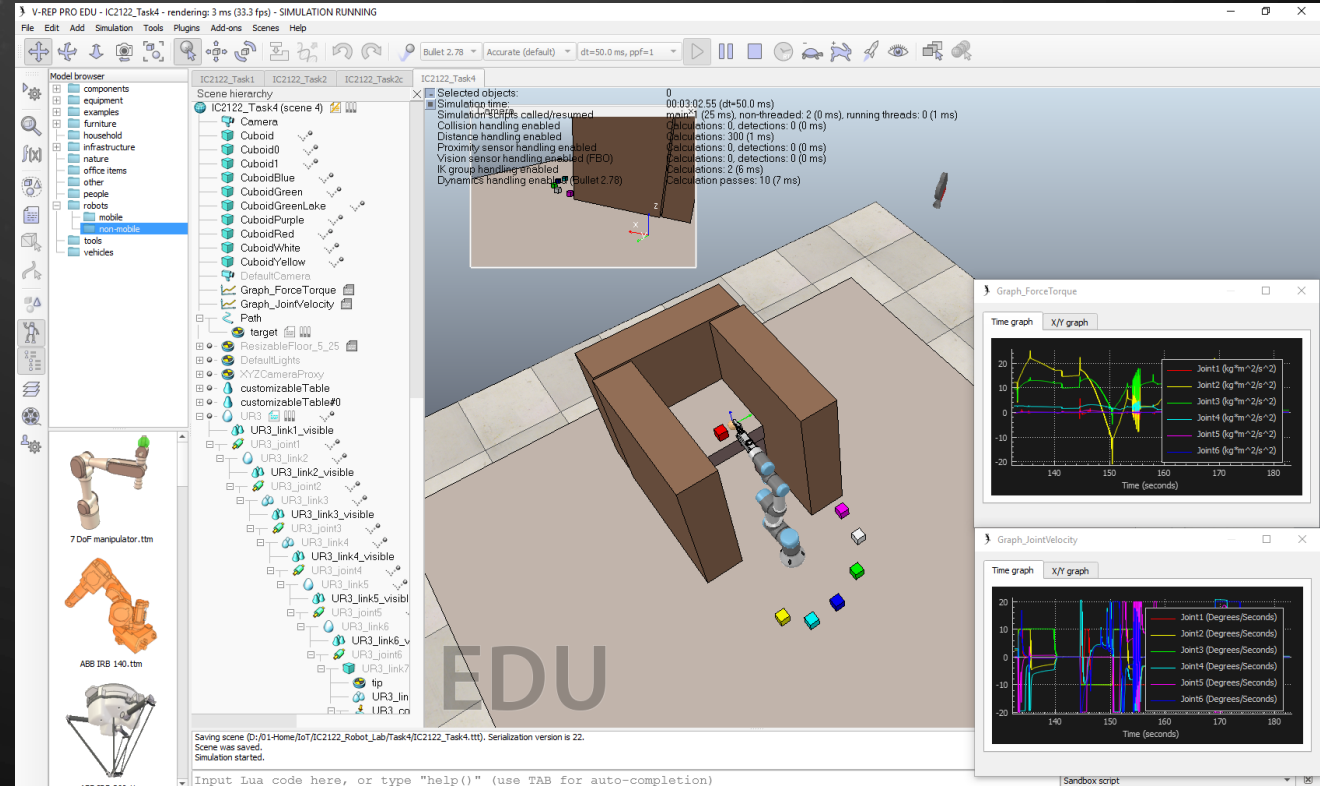
1. Select the object

2. Click

3. Orientation: Alpha (α), Beta (β), Gamma(γ)



Task 3: Pick and Place



Start-up – V-REP

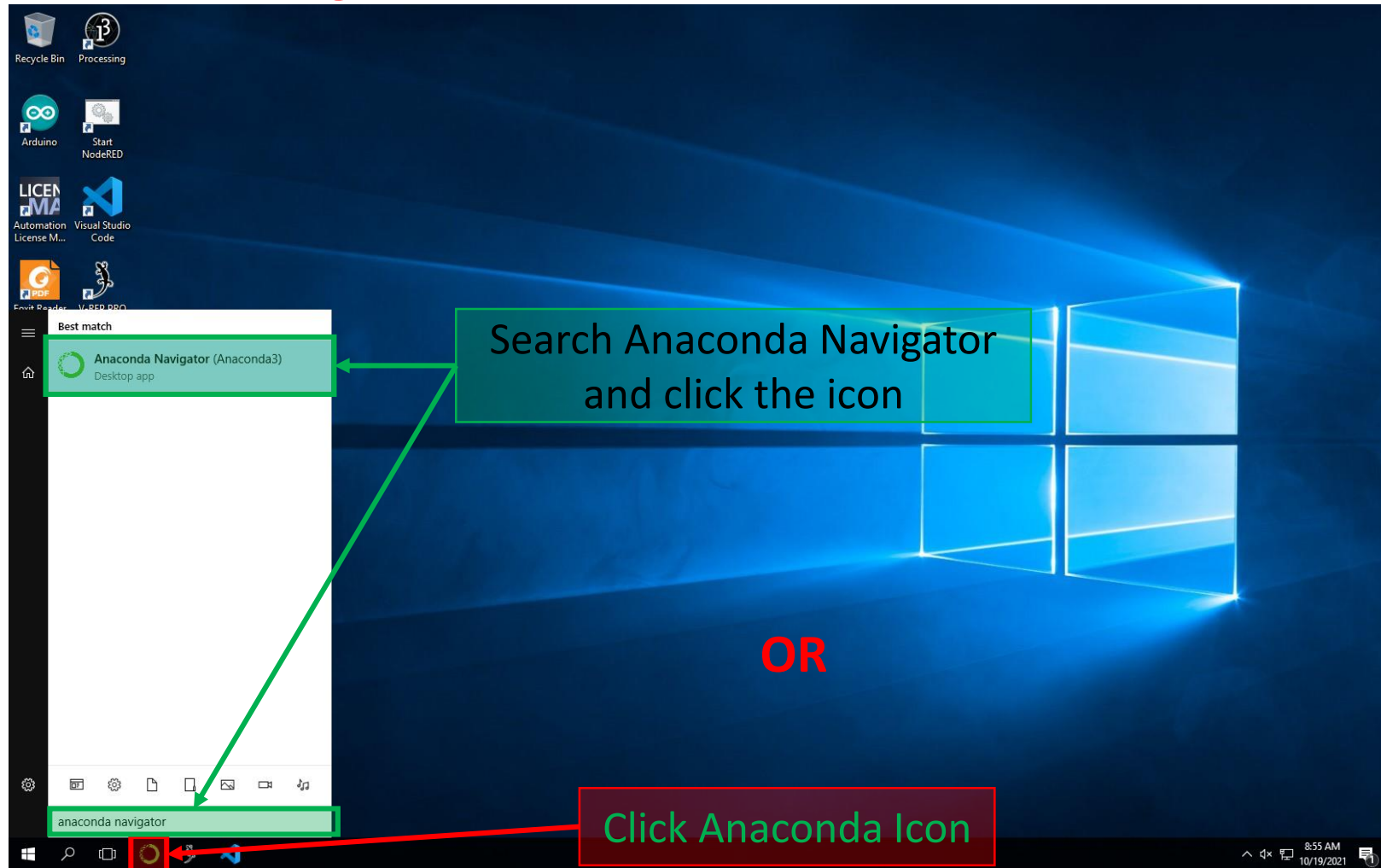
- Start the V-REP (**Task3_vrep.bat**)

The screenshot shows a Windows File Explorer window titled 'IC2122-Robotics' with the address bar displaying 'D:\01-Home\IoT\IC2122-Robotics'. The left sidebar shows the navigation pane with 'DATA (D:)' selected. The main pane displays a list of files and folders. The file 'Task3_vrep' is highlighted with a purple box, and a green box highlights the address bar path. A callout box labeled 'Double-Click' points to the highlighted file.

Name	Date modified	Type	Size
Task1	10/18/2021 9:43 AM	File folder	
Task2	10/18/2021 9:43 AM	File folder	
Task3	10/18/2021 9:44 AM	File folder	
Task4	10/18/2021 9:42 AM	File folder	
IC2122_Task1_r4	10/18/2021 9:41 AM	Microsoft PowerP...	8,301 KB
IC2122_Task2_r4	10/18/2021 9:41 AM	Microsoft PowerP...	6,613 KB
IC2122_Task3_r3	10/18/2021 9:41 AM	Microsoft PowerP...	7,015 KB
IC2122_Task4_r2	10/18/2021 9:41 AM	Microsoft PowerP...	8,072 KB
IC21122-Robotics-Task1-2	10/11/2021 5:21 PM	Microsoft Word 9...	73 KB
IC21122-Robotics-Task3-4	10/12/2021 3:58 PM	Microsoft Word 9...	76 KB
README	9/23/2021 8:53 AM	Markdown Source...	8 KB
Task1_vrep	10/5/2021 9:55 AM	Windows Batch File	1 KB
Task2_vrep	10/5/2021 4:35 PM	Windows Batch File	1 KB
Task2c_vrep	10/5/2021 4:35 PM	Windows Batch File	1 KB
Task3_vrep	10/11/2021 11:30 ...	Windows Batch File	1 KB
Task4a_vrep	10/11/2021 11:31 ...	Windows Batch File	1 KB
Task4b_vrep	10/11/2021 11:31 ...	Windows Batch File	1 KB
Task4c_vrep	10/11/2021 11:31 ...	Windows Batch File	1 KB

Start-up – Anaconda Navigator

- Start the **Anaconda Navigator** on Taskbar or search Windows

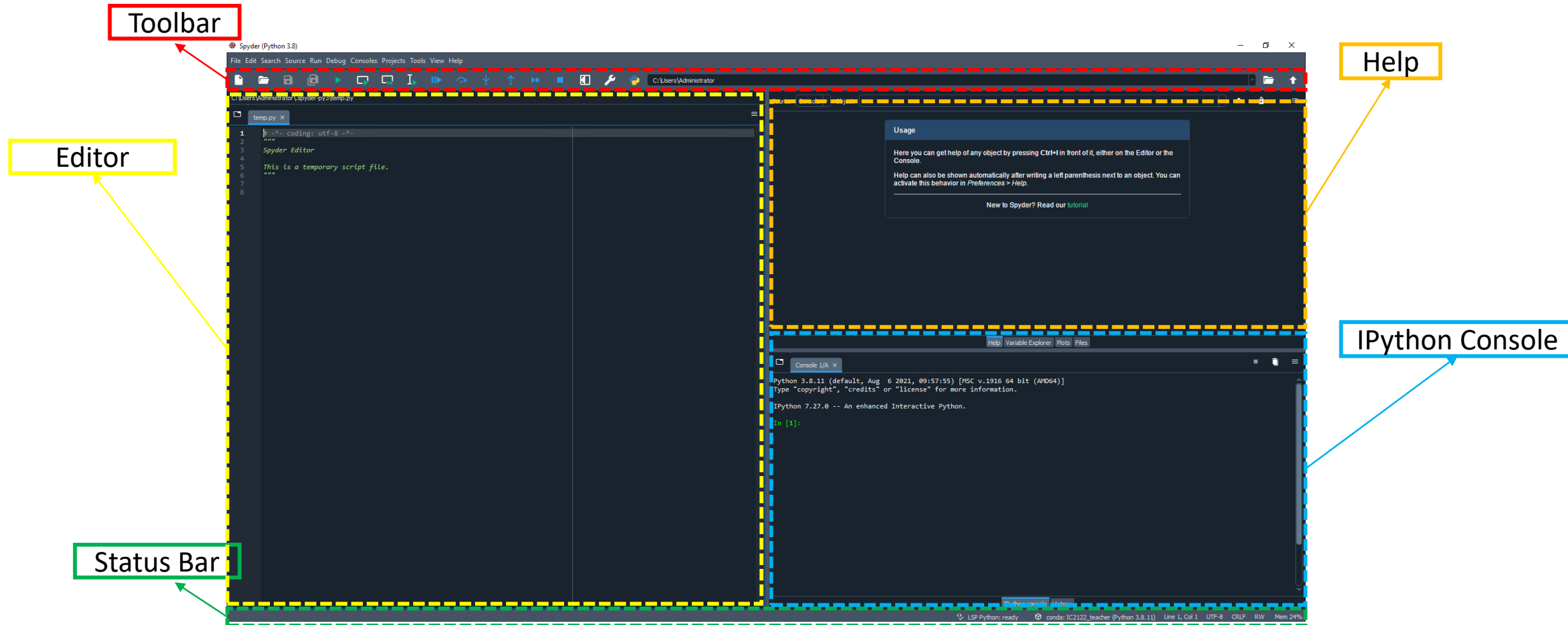


Start-up – Spyder

- Launch Spyder

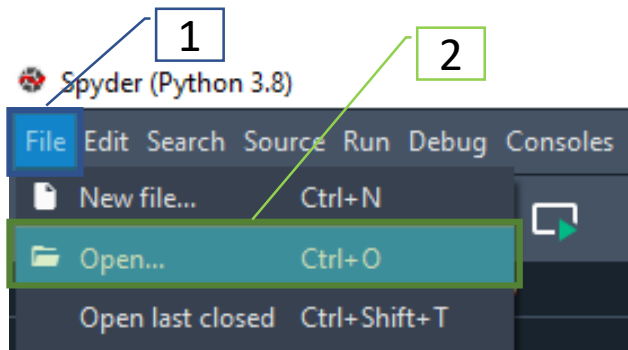
The screenshot displays the Anaconda Navigator application window. The interface includes a top menu bar with 'File' and 'Help', and a left sidebar with navigation options: 'Home' (highlighted with a blue box and callout 1), 'Environments', 'Learning', and 'Community'. The main area is titled 'Applications on' and features a dropdown menu for environment selection (callout 2) showing 'IC2122' and 'base (root)', with 'IC2122' selected (callout 3). Below the dropdown, four application cards are visible: 'Datalore', 'IBM Watson Studio Cloud', 'Qt Console', and 'Spyder'. The 'Spyder' card is highlighted with a yellow box and callout 4, showing its version (5.0.5) and a 'Launch' button. The 'Spyder' card also includes a description: 'Scientific PYTHON Development Environment. Powerful Python IDE with advanced editing, interactive testing, debugging and introspection features'.

Start-up – Spyder

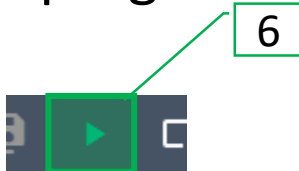


Start-up – Spyder

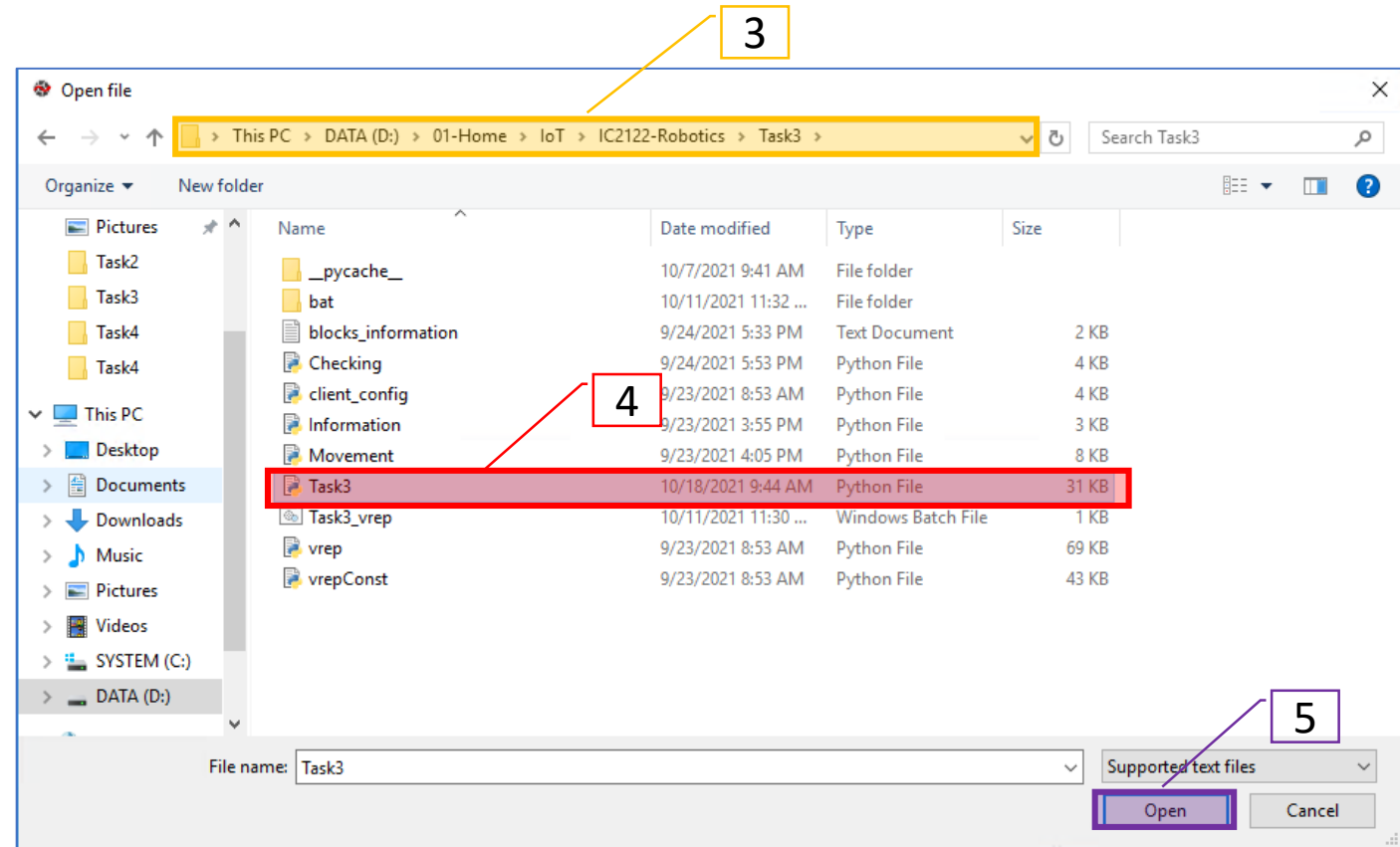
- **Open** Python file at editor



- **Run** the program at Spyder

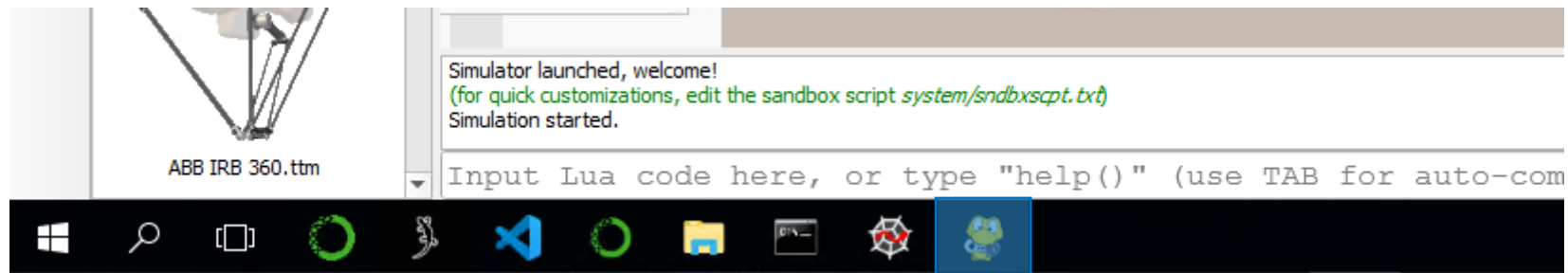


D:\01-Home\IoT\IC2122-Robotics\Task3



Start-up – Control panel window

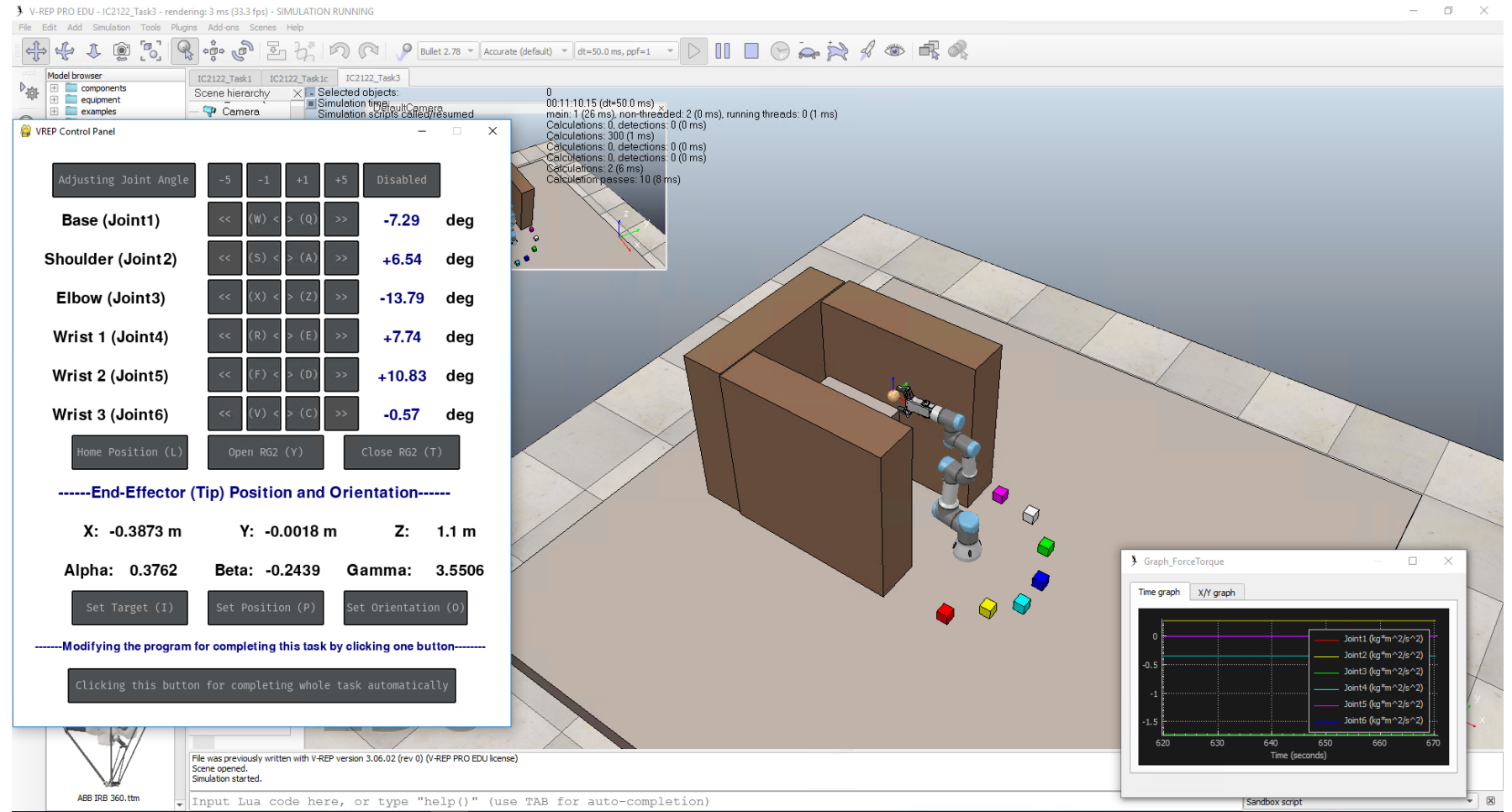
- Control panel window will be appeared after running the program
- After switching to the V-REP, the control panel window will be hidden
- **Click** the Control panel window icon to open it.



Click this icon

V-REP interface

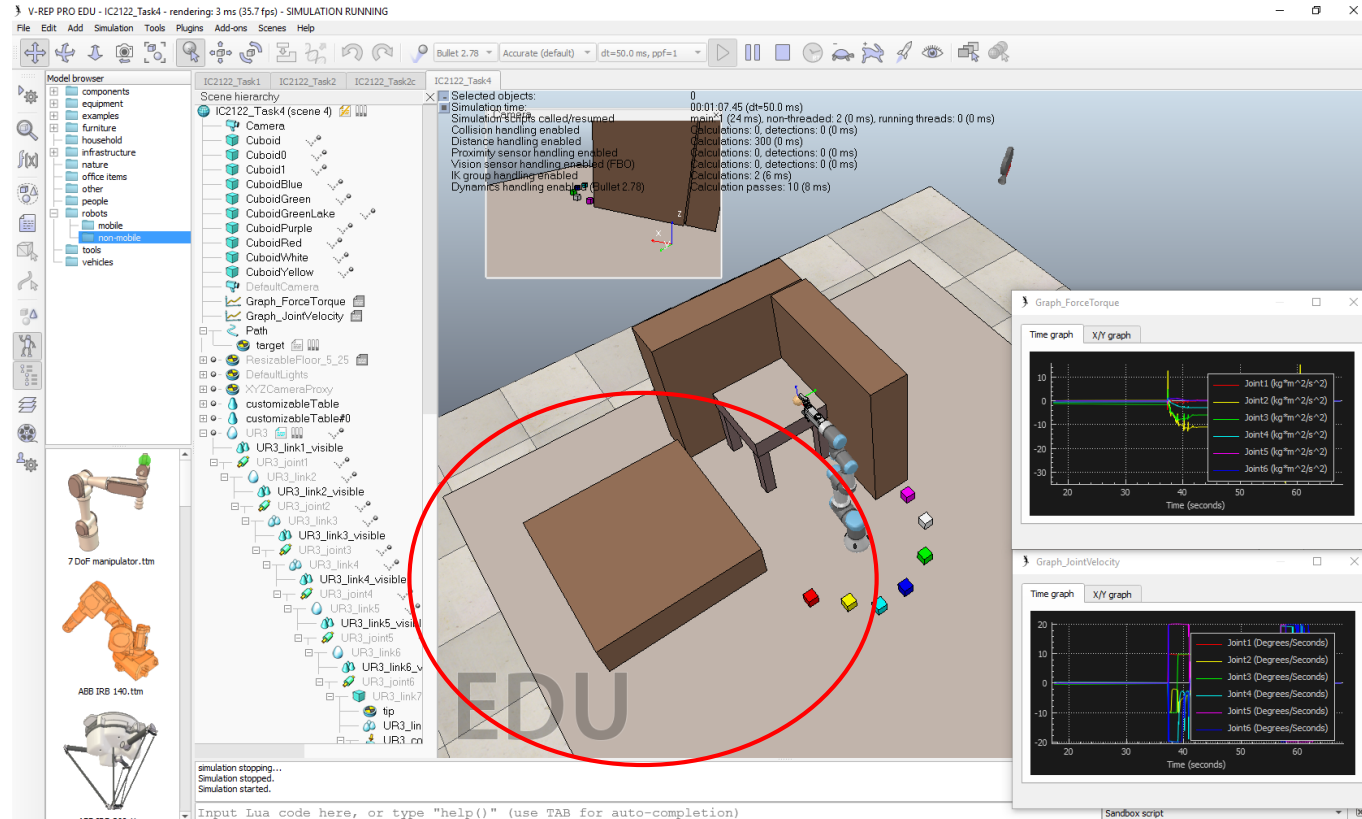
- V-REP interface :



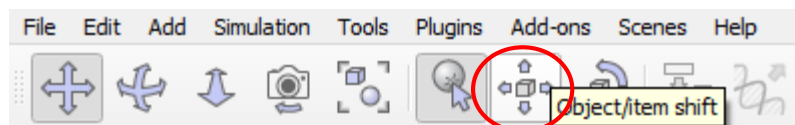
IC2122 – Task 3

- Remarks:

- No collisions on the blocks and walls



- Not allow to move the blocks via V-REP tools



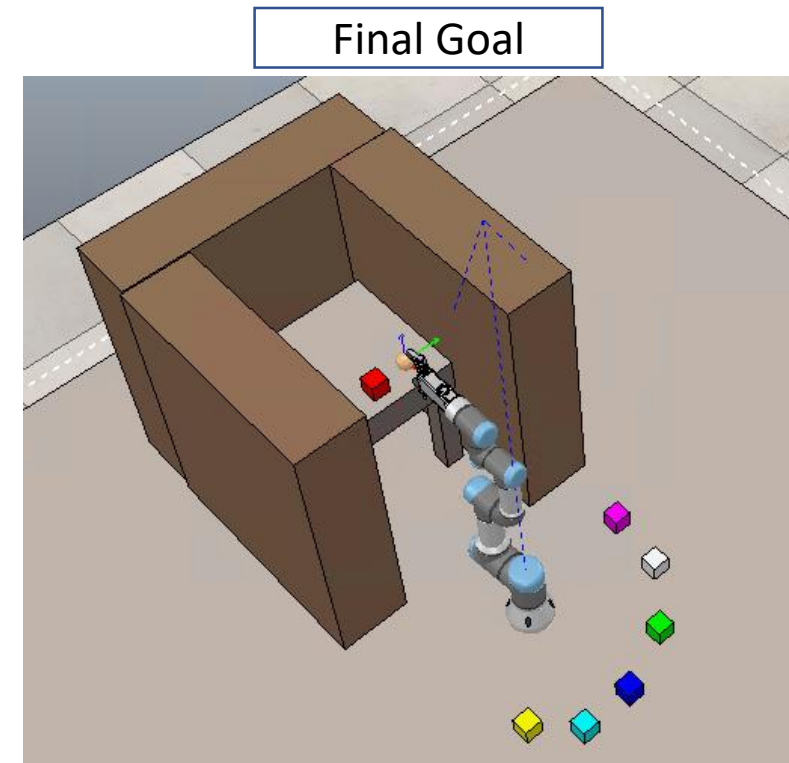
IC2122 – Task 3a



- Task 3a: Assume there has a collaborative robot working in the factory. The color blocks are the raw materials which are placed in the machine for process.
 - Pick the **RED** block and **place** it on the table (machine) using **Inverse Kinematics** for processing and write down the procedure. (**Return to the home position at the final step**)
 - (**Remark: No collisions**)

RED Block original Position:	Position X	Position Y	Position Z
	0.125 m	-0.35 m	0.435 m

RED Block final Position:	Position X	Position Y	Position Z
	≈ -0.667 m	≈ 0 m	0.846 m

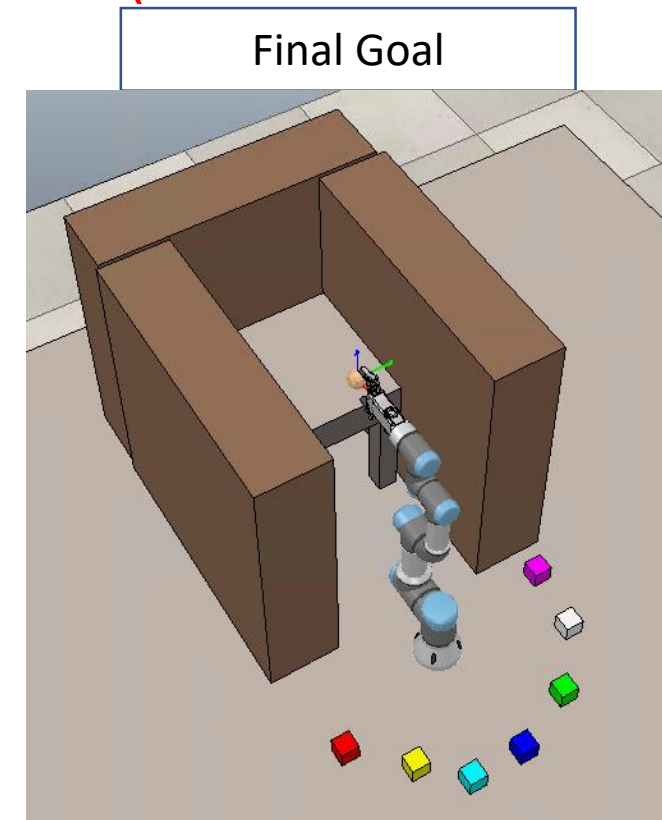




- Task 3b: Continuing in **part a**, the process of material (**RED block**) is completed. Put it back to the original position.
- **Pick** the **RED** block from the table (machine) and **place** it on the original position using **Inverse Kinematics** and write down the procedure. (**Return to the home position at the final step**)

RED Block original Position:	Position X	Position Y	Position Z
	≈ -0.667 m	≈ 0 m	0.846 m

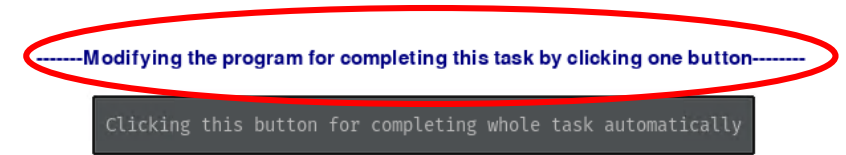
RED Block final Position:	Position X	Position Y	Position Z
	0.125 m	-0.35 m	0.435 m





- Task 3c: Create a **python program** to automate the process of raw material by clicking the **"Clicking this button for completing whole task automatically"** button.

Write down the procedure and explain your program.



1. Pick the **RED** block and place it on the **table (machine)**

2. Return to the **Home Position**

RED Block (table) Position:	Position X	Position Y	Position Z
	≈ -0.667 m	≈ 0 m	0.846 m

3. Pick the **RED** block from table (machine) and place it on the **original position**

4. Return to the **Home Position**

RED Block original Position:	Position X	Position Y	Position Z
	0.125 m	-0.35 m	0.435 m

(Remark: No collisions)

IC2122 – Task 3c

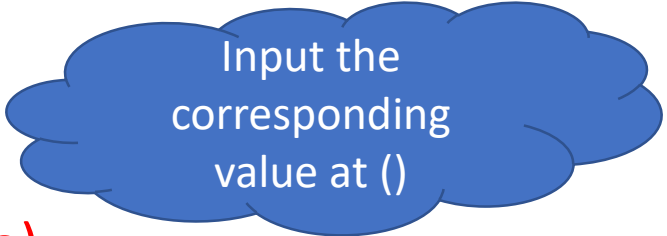
- **Modify** the **Task3.py** (Path: D:\01-Home\IoT\IC2122-Robotics\Task3\Task3.py)
- Useful command:

1. Move the end-effector to position (X, Y, Z)

➤ `movement.setTargetPosition_withoutInput(PosX, PosY, PosZ)`

2. Configure the end-effector's orientation (Alpha, Beta, Gamma)

➤ `movement.setTargetOrientation_withoutInput(Alpha, Beta, Gamma)`



Input the
corresponding
value at ()

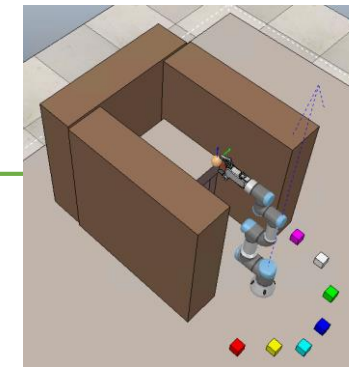
```
# Please input the necessary command for completing this task by clicking one button
# You can review the comments for seeking the useful functions which are located at other files
# (Movement.py, Information.py, Checking.py)
if event.user_type == pygame_gui.UI_BUTTON_PRESSED:
    if event.ui_element == complete_button:
        # -----Example start-----
        movement.setTargetPosition_withoutInput(0.2, -0.2, 0.6) # Move the end-effector to the position X, Y, Z
        time.sleep(5) # Delay 5 seconds for waiting the previous movement
        movement.setTargetOrientation_withoutInput(0, 90, -90) # Configure the end-
effector's orientation Alpha, Beta, Gamma
        # -----Example End-----
        ➡ # Please input your command (functions can be found at Task3.py, Movement.py, Information.py, Checking.py )
        print("Working.....")
```


IC2122 – Example

- According to previous program:

❑ Step 1: Move the end-effector to the position X, Y, Z

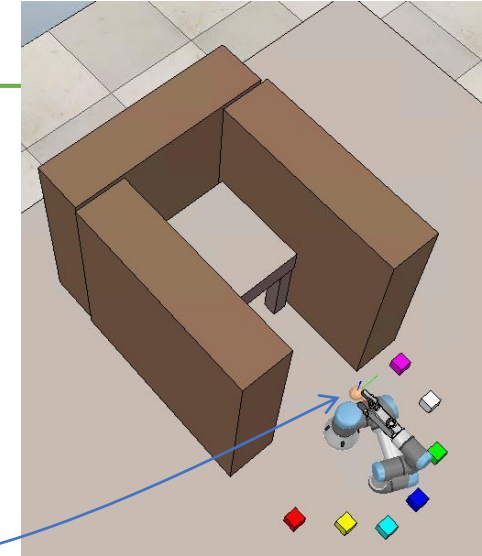
➤ `movement.setTargetPosition_withoutInput(0,0,0.8)`



Original Pose

❑ Step 2: Delay 10 seconds for waiting the previous movement

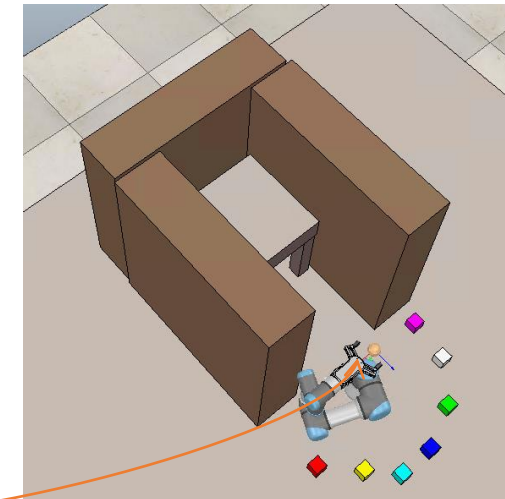
➤ `time.sleep(10)`



Step 1

❑ Step 3: Configure the end-effector's orientation Alpha, Beta, Gamma

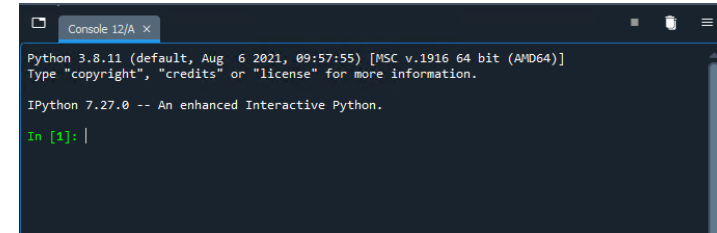
➤ `movement.setTargetOrientation_withoutInput(0,90,-90)`



Step 3

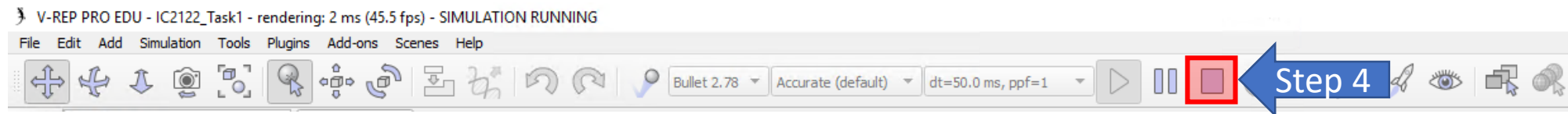
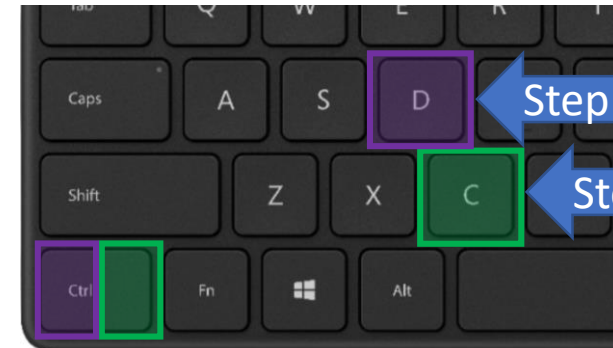
Task3 – Troubleshoot

- Step 1: **Switch** to the Spyder IPython Console

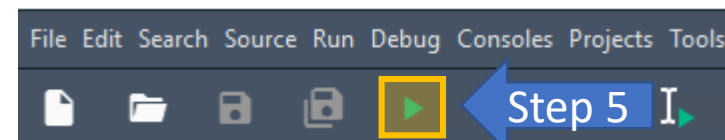


← Step 1

- Step 2: **Stop** the program by **pressing** “Ctrl + C”
- Step 3: **Open** a new console by **pressing** “Ctrl + D”
- Step 4: **Stop** the V-REP simulation



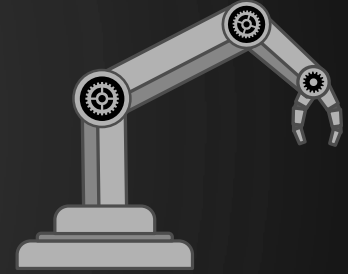
- Step 5: **Run** the program at Spyder





THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

INDUSTRIAL CENTRE
工業中心



Q&A

