3. Basic Robot Programming

Abstract

The purpose of this lab is familiar with the robot program and handling the robot and its controller.

Procedure

1. Turn on the Robot controller and robot as per the instruction.
2. To create the new program and save the program.
3. To learn the basic commands and robot moving functions.
4. To create the simple robot program and control the robot movements.
5. To know about a sequence of program with logic and commands to control the robot movements.

Theory

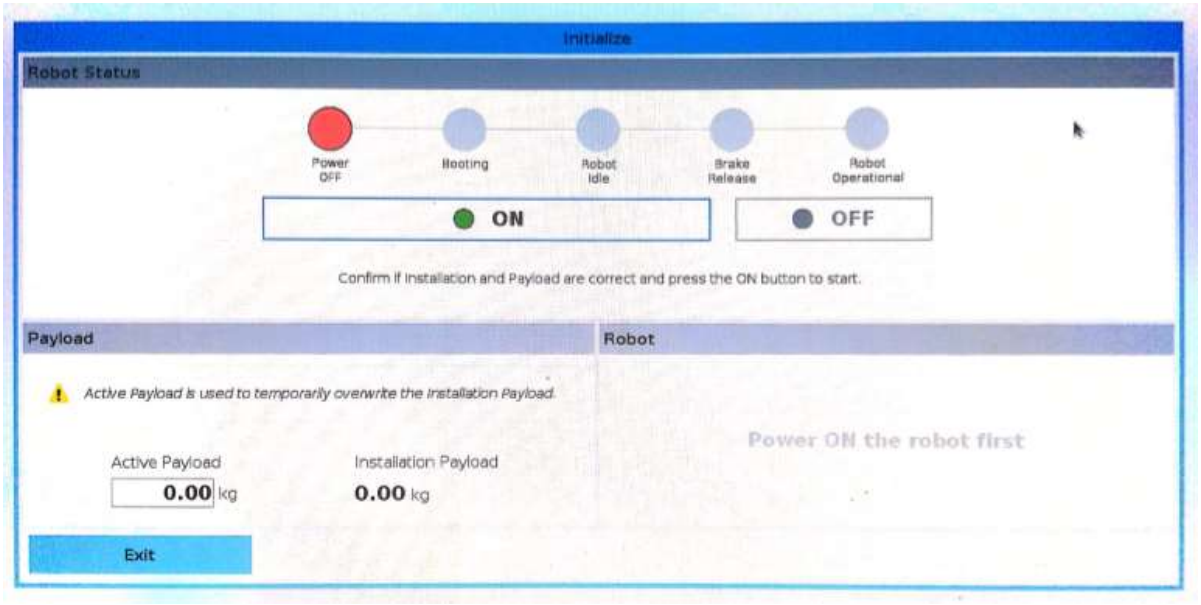
In this lab, you will have done the following things:

- Robot power up process
- Create a new program
- Robot basic commands
- Simple robot program

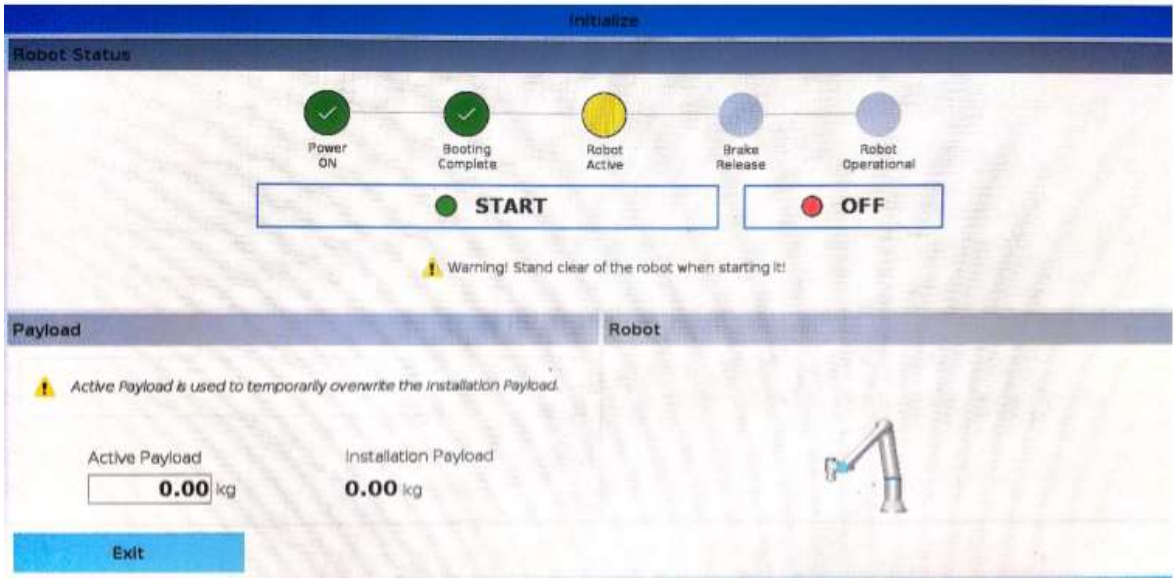
1. Robot power up

The power up, initializes Polyscope, which will allow us to control the robot. The initialization process switch on the power supply of th**e robot and release the brakes**.

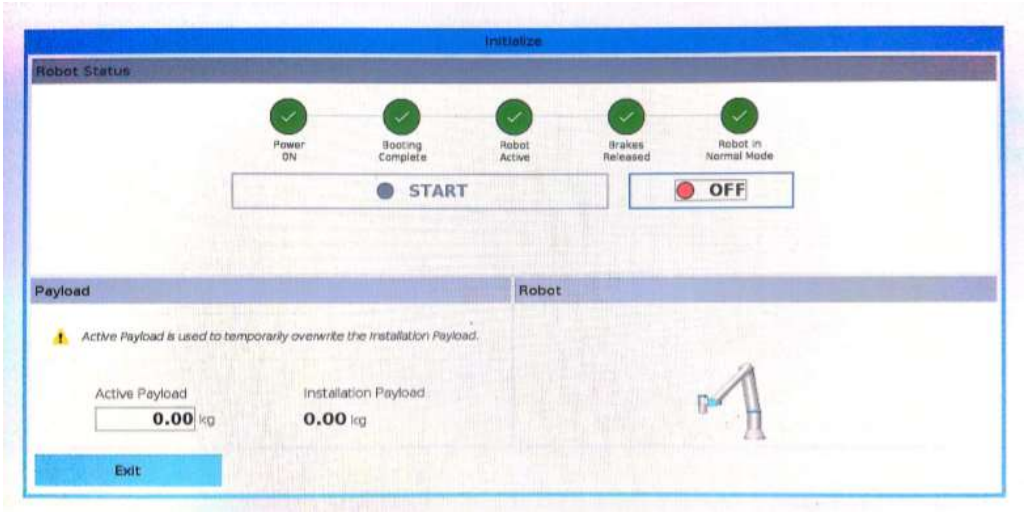
- ❖ Switch on the main power supply, and press the power button on the teach pendent.
- ❖ Go to initialize screen on the teach pendent.
- ❖ In the screen robot status is “POWER OFF” condition. Press the “ON” button in the screen.



❖ Now the robot status is “ROBOT IDLE”. Now press the “START” button.



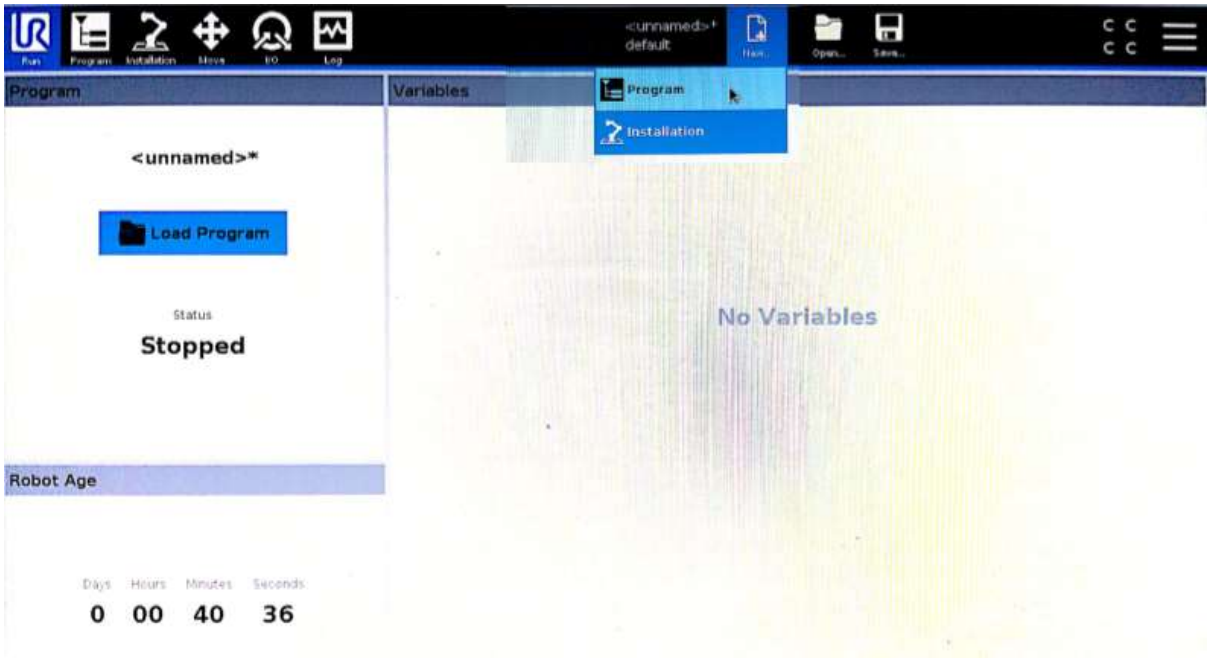
❖ After pressing the start button the robot status will be changed. Now the robot status is in “NORMAL MODE”.



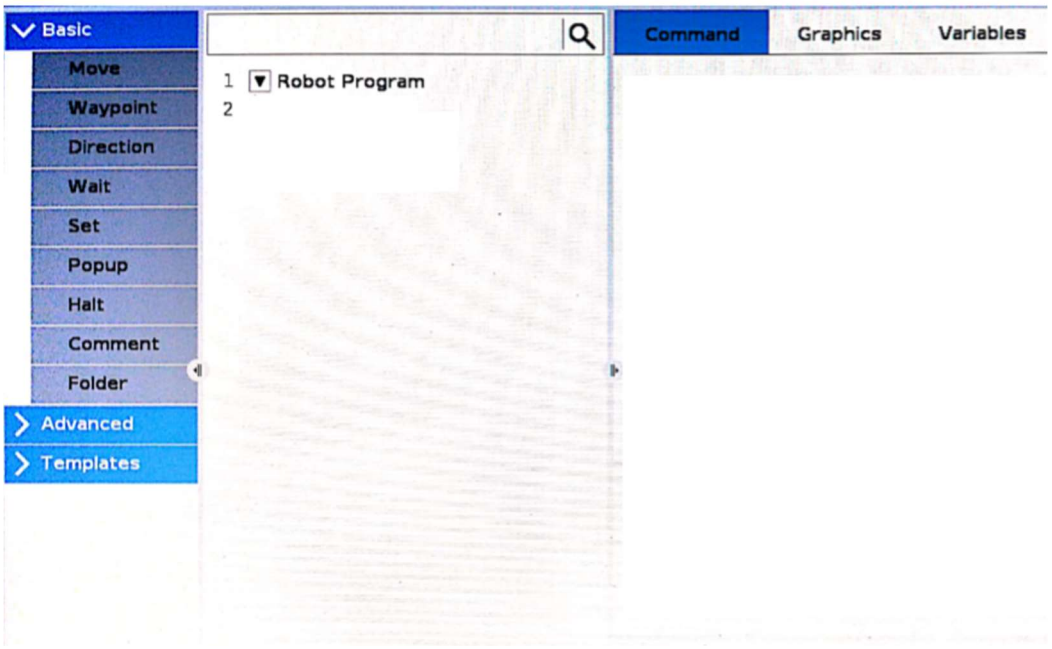
The robot is ready to do the programming. Robot power on process is completed. Now press the “EXIT” button and enter into the “RUN” mode screen.

2. Create a new program

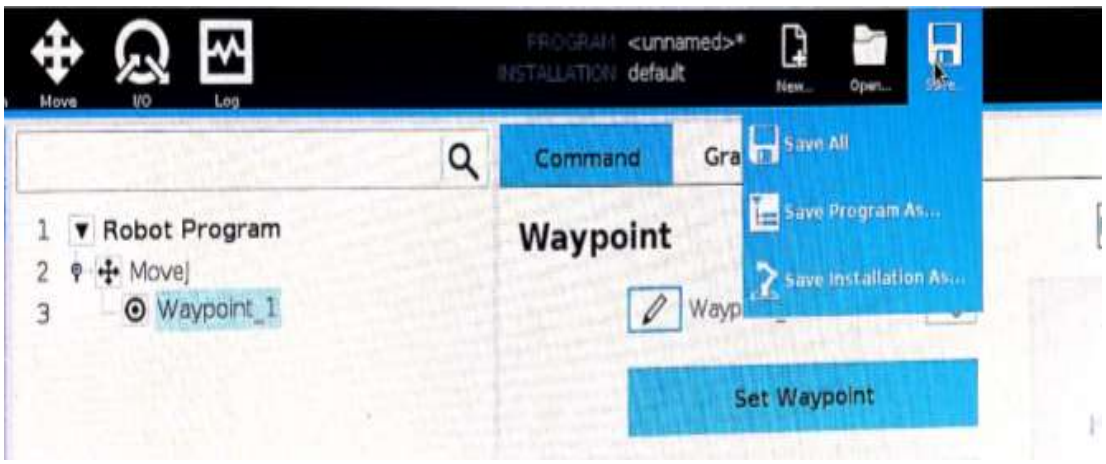
❖ In Run mode top of the screen, there is a “NEW” option. Move the pointer over there and select the “NEW PROGRAM”.



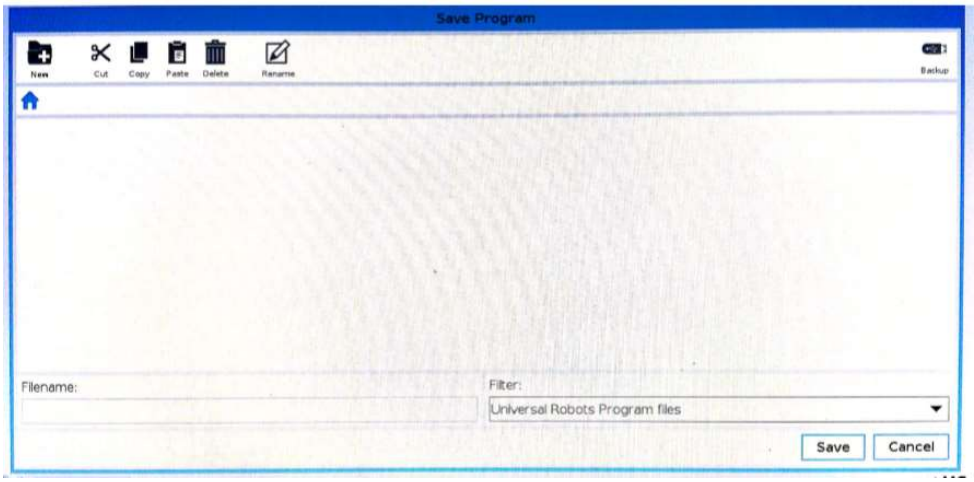
❖ The program tree appears on the screen as per image given below.



❖ Now we need to save the program in a specific name. “SAVE” option is next to the new, and select to “SAVE ALL”.



❖ We should write a program name to the “FILE NAME” tap and click “SAVE”.

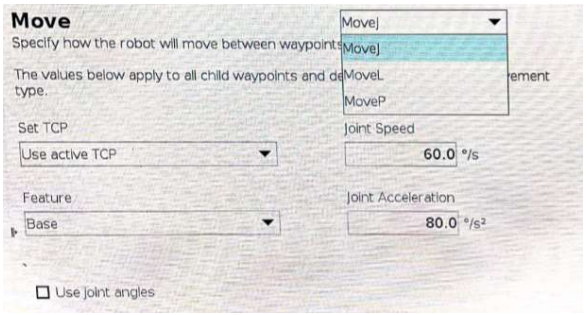


3. Robot basic commands

The robot basic structure contains the basic commands, advanced and Templates. Here we can see about the basic function of the program.

➢ Move - Movement types

- Move J (default)
- Move L
- Move P (Move C)



➢ Waypoint - types

- Fixed (default)
- Relative
- Variable

➢ WAIT

- This command should trigger the robot to next operation in the program.

➢ SET

- The action you wish the robot to perform at this point in the program.
- Also user specify changes in the robot payload.

- POPUP
    - User define a message, warning, and user defined input variable can be using this command.

- HALT
    - Used to stop the robot program once the program executes.

- COMMAND
    - Command is nothing but a message written in the part of program.
    - It contains the program or the line information.

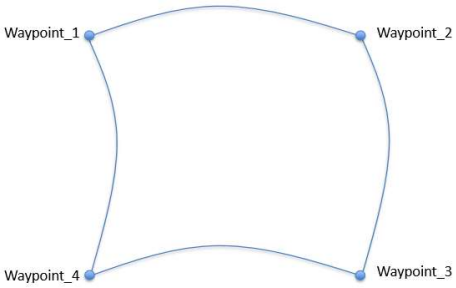
- FOLDER
    - Folder is a function, to having a group of program in it.

Simple program method

To select the move function in the structure. Waypoint automatically added when inserting Move command in the program tree.

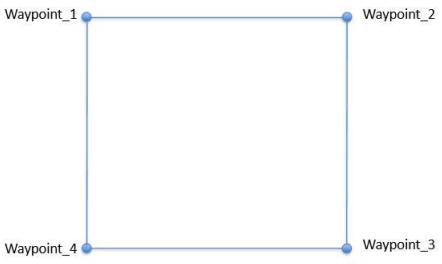
- Move J: Joint movement

    - No interpolation
    - Fastest move type
    - Useful in “free” space movements

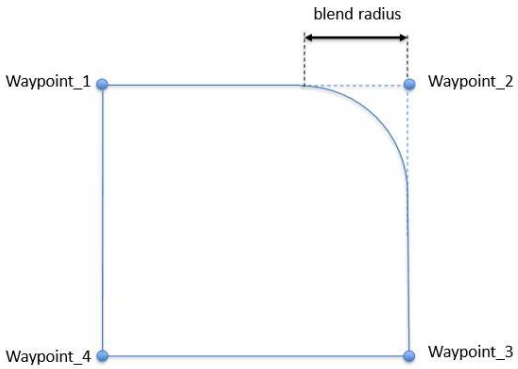


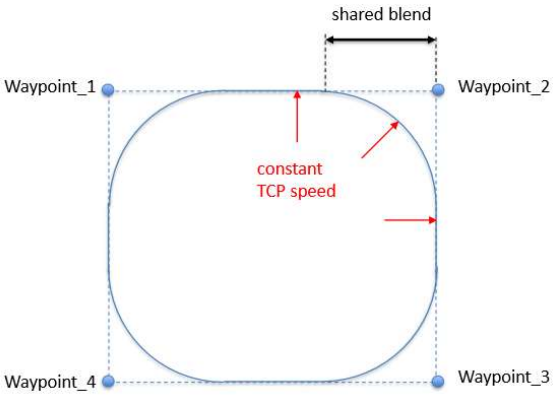
- Move L: Linear movement

    - Interpolation on
    - Linear trajectory for TCP



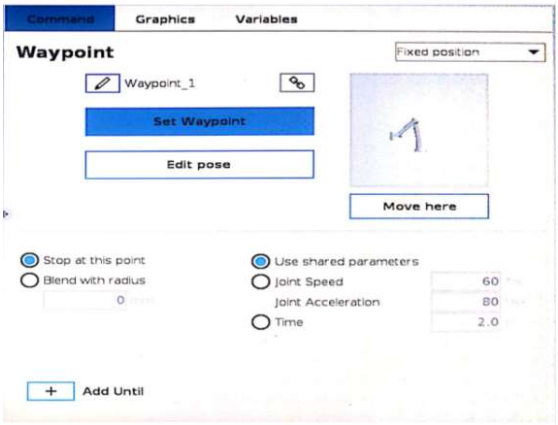
- Blend radius:
  - Continuous movement
  - No stop in Waypoint
  - Waypoint 2 (r=25)



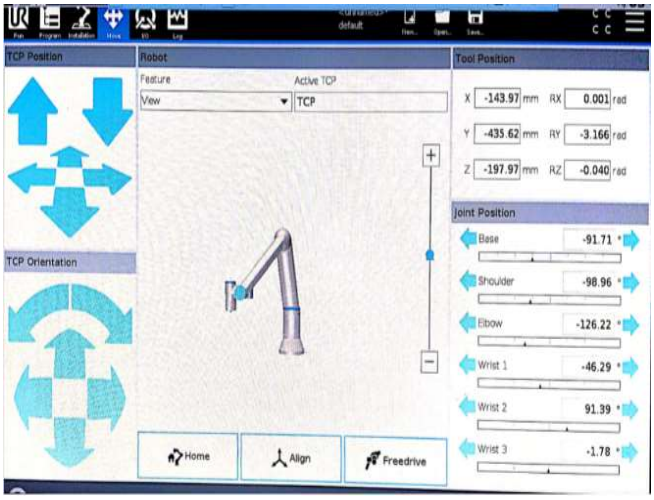


- Move P: Process Movement
  - Process applications
  - Linear movement
  - Constant TCP speed
  - Shared blend radius

- Teach Waypoint
  - Press Set this Waypoint
  - Teach position
  - Press OK for saving



➢ Robot manual movement control



- We can move the robot with respect to the TCP Position or TCP Orientation.
- In TCP position robot movement should be depends upon a RX, RY and RZ.
- In TCP Orientation the robot movement respect to the CX, CY and CZ.
- Also we can move the robot by individual axis by using Joint Position.

➢ Input / Output control

- Robot controller there is a 16-inputs, 16-outputs, 2 analog inputs, 2 analog outputs, 2 Tool DI, 2 Tool DO, and 2 Tool analog inputs are available.
- In that screen, what are all the field input enable its glowing.
- What are all the field devices we wish to enable, we enable the corresponding outputs.

- If there is any communication process for I/O, that is also available here.

Result

Thus, we have studied the Basic Robot Programming commands, Simple program and handling the robot process.

4. Simple Pick and Place Programming

Abstract

To create a simple pick and place robot program, and control the robot with required functions and feedbacks.

Requirements

1. Supply air source
2. Air connection among supply
3. Double acting cylinder
4. Input component
5. Tool mounting gripper

Procedure

- Turn on the Universal Robot and Create a new robot program.
- Create a new waypoint by using a structure in the teach pendent.
- Teach the first waypoint at specified position by using the move window.
- Fix the approach point on top of the component need to pick.
- Create the control instruction to the gripper to pick the component.
- Create the robot moving path to place the component by creating multiple waypoints.
- To create the required control commands, to control the robot movements and robot functions.

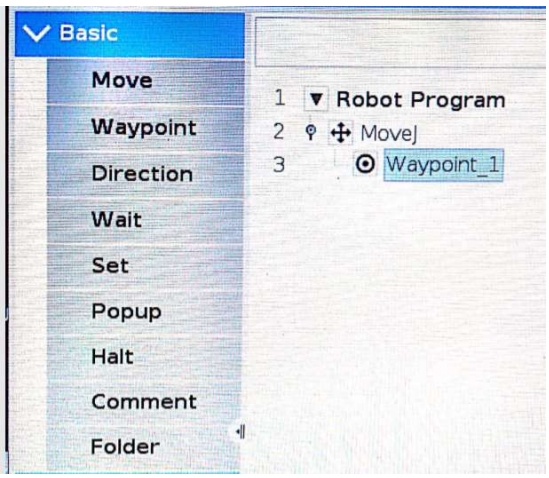
Theory

Pick and place robots have become common place in today's manufacturing environment. Pick and place robots are usually mounted on a stable stand, strategically positioned to reach their entire work envelope. Advanced vision systems enable them to grasp and move objects on a conveyor belt, which can be used in a variety of different ways.

The consistency at which a pick and place robot is able to complete assembly, quality control, packaging and other material handling processes improves the overall quality of production and reduces downtime due to errors. Speed contributes significantly to productivity, as pick and place robots move products through the manufacturing process much quicker than manual options.

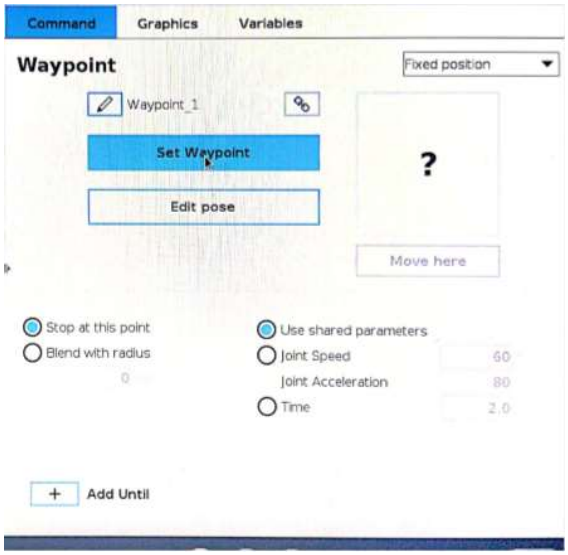
Overall, pick and place robots can provide great return on investment (ROI) for manufacturers because of the productivity benefits they can provide. Pick and place robots help production operations around the world increase their output in a profitable way.

Turn on the robot and its controller by the step by step process explained in the previous lab experiment.



In the program tree, create a move instruction by the basic structure window. A Waypoint will automatically add when inserting Move command in the program tree. Then we need to select the robot movement type. It should be Move J, Move L or Move P. After that we need to teach the waypoint, where robot action started.

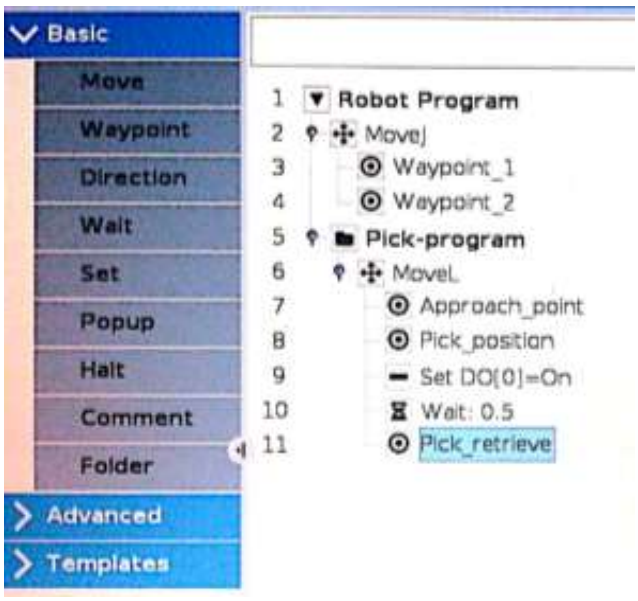
Select the waypoint need to teach and set the waypoint in the command screen. In the command screen we will be able to change the waypoint name, speed of the waypoint, waypoint type (Fixed, Variable, Relative position) and robot action.



When we press the “SET WAYPOINT” button one more screen open. In that screen we move the robot by its specific location, and press “OK” to set the waypoint.

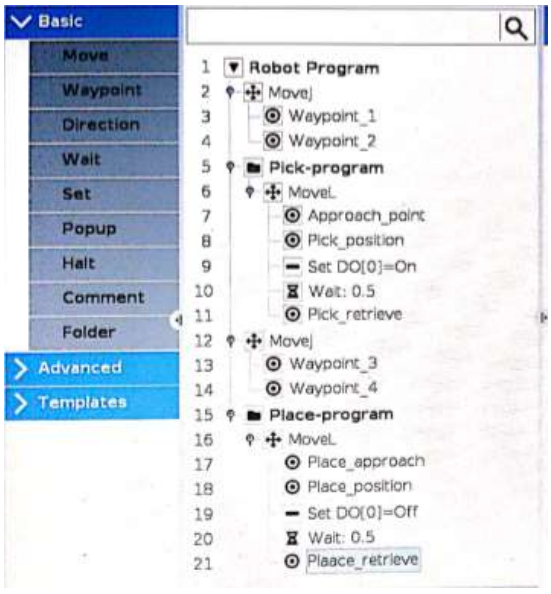
Select the Folder from the basic structure, we can do the picking program in the folder. Press the folder in command screen, keyboard option will appear, and then change the name into Pick-Program and press “SUBMIT”. Now the folder name will be changed.

Then add a waypoint in the folder and to follow the same process to change the waypoint name into “APPROACH POINT”.



Add a two more waypoints and change their name in to “Pick Position” and “Pick Retrieve”. In that folder the robot movement are Linear because Robot move to pick the component in the linear movement. So all the waypoints are under Move L.

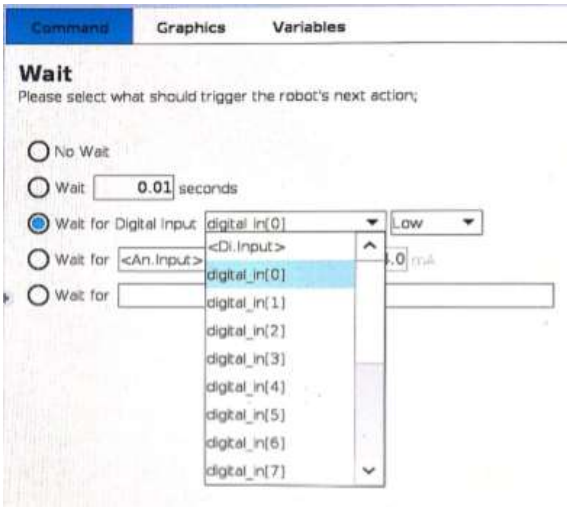
In that action after robot reach the pick position we need to pick the component by using gripper action, so we need to insert the set command to control the gripper Open/Close actions. Where the gripper control connected in the Robot controller output, we call the specific action to control the gripper and to pick the component. For example, here we use the digital output 0 for controlling the gripper open/close function. Then insert the “Wait” command to make delay time to proper holding of the component. Now the robot picking program was ready.

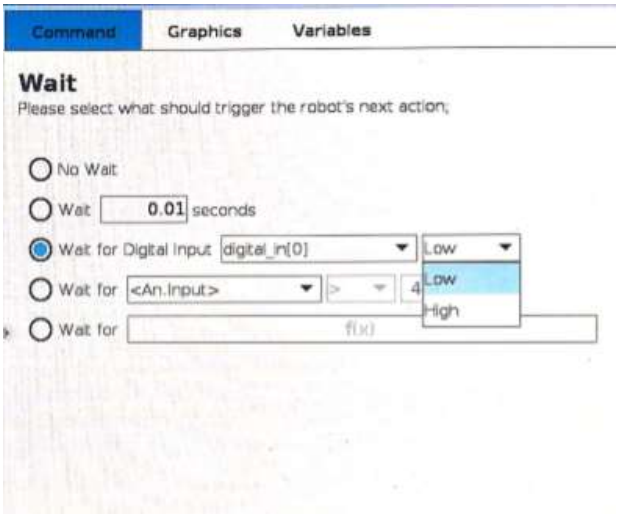


Now by the same method we need to make a new folder program to place the component in the particular place. Once the place program is finished, the robot program is finished without a control. When the user run the program, the robot starts the process, if the component is not present or placed in the pick position also, robot will continue the process by following the program. So, we need to insert the control action in the program.

The user can provide the component present sensor and component placing sensor to control the process. Both of the sensor connected to 2 separate Digital inputs of the robot controller.

If the component presence, the sensor gives its output to “High” else the sensor should be in “Low”. To insert the wait command before pick position and go to command select the option for “Wait for Digital input”. Then press the down arrow to choose the specific input where we connect the pick component sensor input. Here we select the Digital input 0 for that signal.





Then select the sensor signal status to control the program, it should be High or Low. In this program we need to control the program with the sensor High signal status.

Now the controlled robot Pick and Place program is ready to run. If the component is present the sensor signal will be high, and robot will pick the component or else robot will wait for the component till present sensor signal turns into “High”. For the same process inverse the placing component, if the component placing sensor signal is “Low” the robot will place the component in the specified location or else the robot will wait for the component placing sensor signal till it turns into “Low”.

Result

A simple pick and place robot program, control the robot with required functions and feedbacks was created successfully.