Sheridan Institute of Technology and Advanced Learning Faculty of Applied Science and Technology

ENGI30172: Robotic Applications

Project #2: Working with Offsets, For and While Loop, and Operator Communication

Section #: 1175_78890

Station # 4

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Table of Contents

Task Description

The task for this project was to create a program in the flex-pendent that would move along the desired path and enable the robot to stack 4 bags onto 3 different level platforms while giving the operator a process feedback on the number of bags stacked through a programmed counter. This was done by first creating coordinates for the tool used in the lab. Then in the program, the position of the work-object was called “Wobj-project”. Like the previous experiment, all of work space was clear of any objects that were not part of the experiment to ensure that the work space was free before the procedure for this project began. Ideally, the outcome of this project was for the robot arm to stack a required number of bags onto 3 different platforms in a cycle while allowing the operator to observe the robot’s stacking progress through a counter command in the program

List of Equipment

- Robot Model: ABB IRB 120 Robot
- Pencil (tool)
- Masking tape (Work-Object)
- Robot Studio (Computer)
- Control Lights
- Work-cell

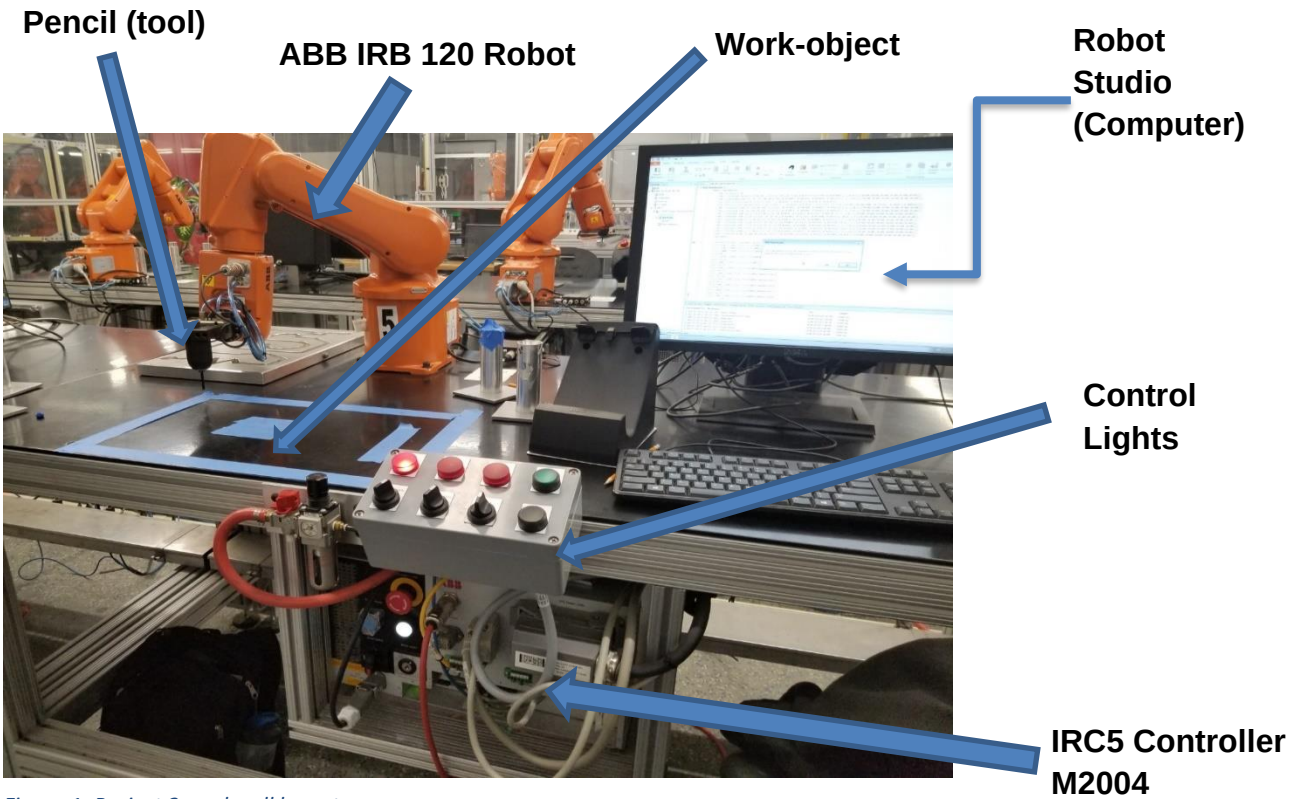

Figure 1: Project 2 work-cell layout

System Setup

The Lab was conducted in the following procedure

Step 1: Turn on the flex-pendent, computer and the IRC5 controller

Step 2: Ensure that the work-cell has space and the desk is free of objects

Step 3: Place the work-object in a desired spot in the work-cell and create a boundary using masking tape.

Step 4: Attach the tool into the Pneumatic mechanical grippers of the robot

Step 5: Plot the desired points on the masking tape boundary

Control Program

```
MODULE MainModule

     VAR num nCount:=0;

     CONST robtarget pstart:=[[355.07,-
7.63,613.99],[0.73281,0.0257775,0.67986,0.0107604],[-
1,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

     CONST robtarget p10:=[[-237.11,-40.20,9.34],[0.432083,-
0.605916,-0.454836,-0.489177],[-1,-
1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

     TASK PERS wobjdata
wobj1:=[FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[0,0,0],[1,0,0,0]]];
```

```
    TASK PERS wobjdata
wobjproject:=[FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[323.576,-
37.1726,119.06],[0.0163306,-0.723761,-0.688177,0.048119]]];

    CONST robtarget p20:=[[-229.80,160.77,-9.15],[0.432075,-
0.605908,-0.454815,-0.489215],[-1,-
1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    CONST robtarget p30:=[[-229.80,160.77,-9.15],[0.432075,-
0.605908,-0.454815,-0.489215],[-1,-
1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    CONST robtarget p40:=[[-52.59,65.41,1.29],[0.426434,-
0.611163,-0.459389,-0.483317],[-1,-
1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    CONST robtarget p50:=[[185.62,131.10,-15.91],[0.426491,-
0.611116,-0.459394,-0.483322],[0,0,-
1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    CONST robtarget p60:=[[-9.46,129.97,-6.56],[0.426467,-
0.611146,-0.459407,-0.483292],[-1,-
1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    CONST robtarget p70:=[[186.97,132.75,-16.11],[0.426469,-
0.61113,-0.459383,-0.483334],[0,0,-
1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    CONST robtarget p80:=[[-55.35,129.75,-4.33],[0.426482,-
0.611102,-0.459342,-0.483396],[-1,-
1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    CONST robtarget p90:=[[185.43,130.11,-15.76],[0.426496,-
0.611081,-0.459329,-0.483424],[0,0,-
1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
```

```
    CONST robtarget p100:=[[-5.40,67.23,-11.33],[0.432098,-
0.605923,-0.454763,-0.489223],[-1,-
1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget p110:=[[184.34,129.28,-15.67],[0.426304,-
0.611239,-0.45921,-
0.483505],[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    PROC main()
    TPReadNum nCount, "how many levels are needed?";
    MoveJ p10, v1000, fine, tool0\WObj:=wobjproject;
    MoveL p30, v1000, fine, tool0\WObj:=wobjproject;
    MoveL p100, v1000, fine, tool0\WObj:=wobjproject;
    WaitTime 1;
    MoveL p110, v1000, fine, tool0\WObj:=wobjproject;
    WaitTime 1;
    MoveL p40, v1000, fine, tool0\WObj:=wobjproject;
    WaitTime 1;
    MoveL p50, v1000, fine, tool0\WObj:=wobjproject;
    WaitTime 1;
    MoveL p60, v1000, fine, tool0\WObj:=wobjproject;
    WaitTime 1;
    MoveL p70, v1000, fine, tool0\WObj:=wobjproject;
    WaitTime 1;
    MoveL p80, v1000, fine, tool0\WObj:=wobjproject;
    WaitTime 1;
    MoveL p90, v1000, fine, tool0\WObj:=wobjproject;
```

```
    WaitTime 1;
    MoveJ p10, v1000, fine, tool0\WObj:=wobjproject;
              SetDO doPL1, 1;
    ENDPROC
ENDMODULE
```

Observations

The main concept of this project was to create a program that would allow the robot to stack 4 bags onto several different levels on a platform while relaying the information of the number of bags stacked on various levels to the operator. From this experiment, through the use of the various commands the robot was able to move along the path and stack the required number of bags onto each platform but was unable to continue in the required number of cycles needed as the program would have to be restarted in order to do the next platform.

Safety

Some safety protocols that were done to ensure safe movement of the robot in the work-cell was the use of increments on the flex-pendent to control the speed of the robot while obtaining the necessary targets on the desired path needed for this project. Also, the work envelope was clear of all objects not part of the experiment to make full use of the robot's movement and it's 6 degrees of freedom in the joints.

Discussion

From this project, the desired outcome was for the robot to be able to stack the required number of bags onto various platforms in a cycle while providing feedback to the operator on the number of bags stacked onto the number of levels until the task was complete which would be indicated by a red light. In the program, the counter showed the number of bags being stacked onto one of the platforms and when the process was complete, the robot stopped, and the red light turned on indicating that the process had finished. However, as the robot returned to the home position, the cycle did not start again as the process needed to be restarted again by pressing the play button on the flex-pendant to continue the process again. The reason for this is due to an error (missing command) in the programming.