

Robot Training Cell

Cummins Meritor



PROBLEM STATEMENT

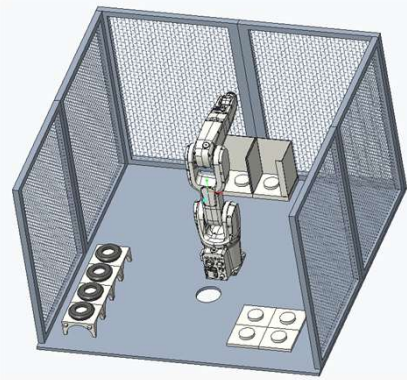
- Develop an introductory ABB robotic training program (short form and long form) that would simulate a day-to-day production environment. The training guide will include the following:
 - Routines
 - What Routines are available?
 - When to use them?
 - Position
 - Which positions to modify?
 - Modifying a Position
 - How to?
 - Common Mistakes
 - Speed
 - When it affects the program?
 - Work Object
 - How are they used?
 - Zone
 - What is this used for?
 - Kill switch
 - Safety features
 - Pre-program end effector check
 - Kill switch
 - Event messages
 - Auto stop open
 - Remove finished parts and load blank conveyor
 - Inbound conveyor is now loaded

REQUIREMENTS

#	Description
1	Complete IRC5 Robot Training 1
2	Design & 3D Print workstation components
3	Create layout for components within the cell
4	RobotStudio® Simulation
5	Bolt down workstations onto the cell table
6	Manually implement and modify RobotStudio® code to ABB Robot
7	Run multiple trials
8	Create short form manual
9	Create training cell manual

FINAL DESIGN, APPROACH, PLAN

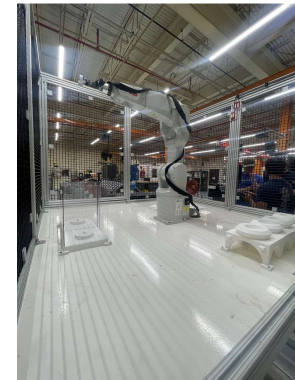
FINAL CREO ASSEMBLY



3D PRINTED PARTS

- IN-BOUND CONVEYOR BELT
- LEFT LATHE MACHINE
- RIGHT LATHE MACHINE
- PALLET
- 4 RING GEARS

ROBOTIC CELL LAYOUT

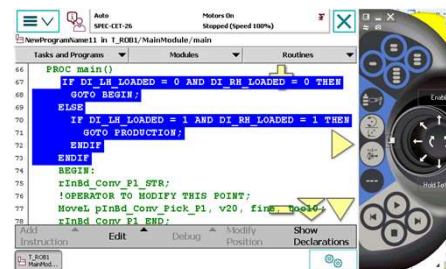


PARTIAL CODE FOR ROUTINE

```

PROC main()
  IF DI_LH_LOADED = 0 AND DI_RH_LOADED = 0 THEN
    GOTO BEGIN;
  ELSE
    IF DI_LH_LOADED = 1 AND DI_RH_LOADED = 1 THEN
      GOTO PRODUCTION;
    ENDIF
  ENDIF
BEGIN;
  rInBd_Conv_P1_STR;
  !OPERATOR TO MODIFY THIS POINT;
  MoveL pInBd_Conv_Pick_P1, v20, fine, TGRIP_1;
  rInBd_Conv_P1_END;
  rLoad_LH_Lathe_STR;
  !OPERATOR TO MODIFY THIS POINT;
  MoveL pLH_Lathe_Drop, v20, fine, TGRIP_1;
  rLoad_LH_Lathe_END;
  rUnLd_LH_Lathe_STR;
  
```

Initialize main procedure
 This checks if the lathes are loaded or not and will send the robot to the correct position
 Production is located on slide 27
 Beginning of code, calls the first routine, inbound conveyor part 1 start. The operator can modify the point in the MoveL line of code (pInBd_Conv_Pick_P1). This is the pickup point for part 1.
 The code calls upon 2 routines to get the part in the general location of the Left lathe, rInBd_Conv_P1_END; rLoad_LH_Lathe_STR;
 This is the drop off point when loading the lathe, the operator can also modify the point in the MoveL line of code (pLH_Lathe_Drop)
 Once the gear is in the lathe, the code call upon routine rLoad_LH_Lathe_END; this tells the robot that the left lathe is loaded.
 The code calls upon routine rUnLd_LH_Lathe_STR; to start unloading the left lathe.



Flex-pendant code layout



ROBOT GRIPPER & ENDEFFECTOR DESIGN

SUMMARY

- A training robot cell was developed and setup to meet the requirements provided by Cummins Meritor. The idea of the training cell robot is for newly hired operators to learn how to use an ABB robot before they are placed on the floor where they are required to use a robot daily. By using the short manual and detailed manual newly hired operators will develop skills to work through any issues encountered during their actual job.
- Special features include:
 - 3D printed simulation components
 - Robot studio simulation
 - Easy removal Shunk robot gripper & attachment design
 - User friendly training code
 - Short form manual for cell
 - Detailed training cell manual

TEAM & ACKNOWLEDGEMENTS

Students

- Kevin Loaiza (ECET)
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- Cristian Trujillo Tavera (ME)
- Jesse Mull (ET)

Faculty Mentor

- Sudhir Kaul

Sponsor Contact

- Jeremiah Mull
- Howard Townsend
- Mark Pless



References

- IRB 1200 - Articulated robots portfolio
<https://new.abb.com/products/robotics/robots/articulated-robots/irb-1200>
- NGP 25 - Shunk Robot Gripper
<https://schunk.com/us/en/gripping-systems/parallel-gripper/egp/egp-25-n-b/p/00000000000310900>