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Expt. Name INTRODUCTION TO SIMULATION

Date: 9/1/2024

Lab objectives:

- * understand the functionality of robot actuators
- * Explore kinematics structure of the ABB IRB - 1520 robot
- * Learn about the importance of robot safety systems and their implementation.

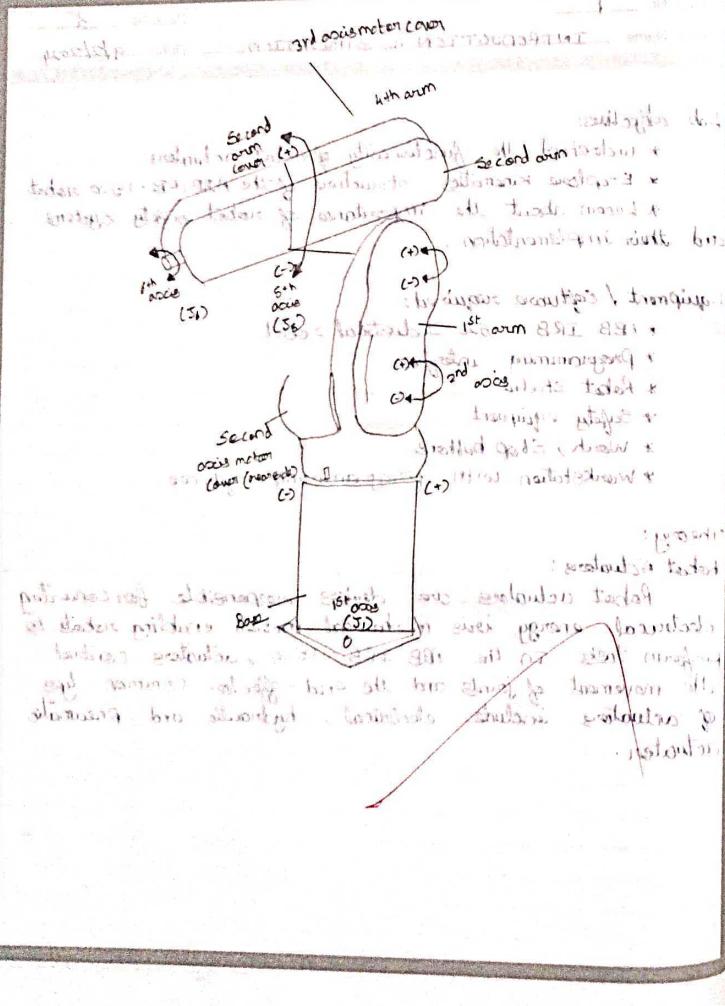
Equipment / Software required:

- * ABB IRB - 1520 Industrial robot
- * Programming interface
- * Robot studio
- * Safety equipment
- * Work, Stop buttons
- * Workstation with programming software.

Theory:

Robot Actuators:

Robot actuators are devices responsible for converting electrical energy into mechanical motion enabling robots to perform tasks. In the ABB IRB - 1520, actuators control the movement of joints and the end-effector. Common types of actuators include electrical, hydraulic and pneumatic actuators.



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Robot kinematics:

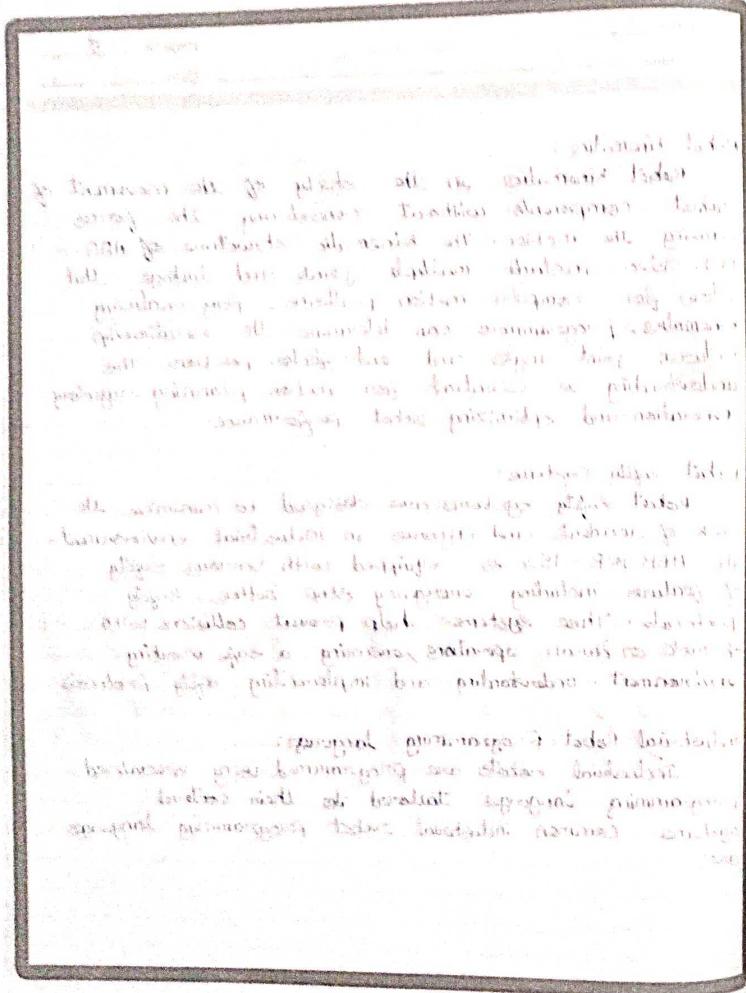
Robot kinematics is the study of the movement of robot components without considering the forces causing the motion. The kinematic structure of ABB IRB-1520 includes multiple joints and linkage that allow for complex motion patterns. By analyzing kinematics, programmers can determine the relationship between joint angles and end-effector positions. This understanding is essential for motion planning, trajectory generation and optimizing robot performance.

Robot safety systems:

Robot safety systems are designed to minimize the risk of accidents and injuries in industrial environment. The ABB IRB-1520 is equipped with various safety features including emergency stop buttons, safety protocols. These systems help prevent collisions with obstacles or human operators, ensuring a safe working environment. Understanding and implementing safety protocols.

Industrial Robot Programming Languages:

Industrial robots are programmed using specialized programming languages tailored to their control systems. Common industrial robot programming languages are:



Rapid:
ABB robots, including the IR.B-1620, use Rapid as their native programming language. It is a high-level task-oriented language designed for ease of use and quick deployment of the robot applications.

KUKA Robot Language:
KUKA robots use KRL for programming, which is a high-level language similar to C++ and Pascal.

FANUC Robot Language (FRL):
FANUC robots utilize FRL, a language optimized for controlling robotic movements and tasks.

Lab Guidelines:

- * Follow all safety protocols outlined by the instructor.
- * Work in pairs or groups to troubleshoot and solve programming challenges.
- * Keep the work area clean and organized.
- * Report any equipment malfunctions or safety concerns promptly.

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Expt. Name SIMULATION BASICS OF IRB 1620 ROBOT Date: 23/2/2024

Aim:

Basic simulation of the industrial IRB 1620.

Robot specifications :

Robot make : ABB

Model : IRB 1620

Poly load capacity : 4.5 Kg

Maximum reach : 1.5 M

Configuration : Articulated/ Joint arm

Gripper type : Mechanical gripper

No. of axes : 6 axes

Procedure:

- * Turn the robot and connect it steadily.
- * use up and down for axis 2 motion.
- * use left and right for axis 1 motion (base).
- * use clockwise and anticlockwise for 3rd axis.
- * For the minor axis , change in settings.
- * use left and right for axis 4.
- * use up and down for axis 5.
- * use clockwise and anticlockwise for axis 6.

Result:

The basic simulation of the industrial robot was done successfully.

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Expt. Name ROBOT SIMULATION - SIMPLE PICK AND PLACE Date: 23/2/2024

Aim:

To move an object by basic simulation simple pick and place operation.

Robot specification:

Robot make : ABB

Robot Model : IRB 1620

Pay load capacity : 4.5 kg

Maximum reach : 1.6M

Configuration : Articulated / Jointed arm

Gripper type : Mechanical gripper

No. of axes : 6 axes

Procedure:

* Turn on the robot and connect it steadily.

* For major axis:

i) use left and right for axis 1.

ii) use up and down for axis 2

iii) use clockwise and anticlockwise for axis 3

* For minor axis:

i) use Left and Right for axis 4,

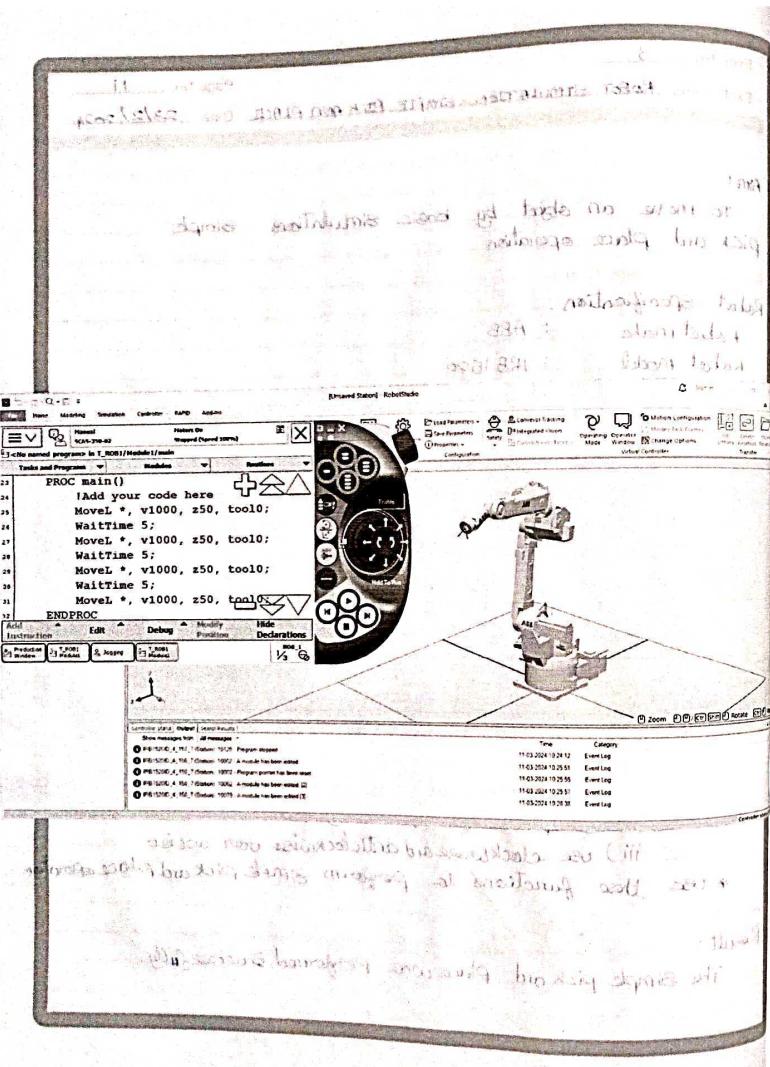
ii) use up and down for axis 5

iii) use clockwise and anticlockwise for axis 6

* Use these functions to perform simple pick and place operation.

Result:

The simple pick and place was performed successfully.



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Expt. Name SIMULATION OF BASIC Program in Robot studio Date : 12/20/24

Aim:

To perform a simple programming using move L command instructions for IRB 1620 1D Robot in Robot studio

Apparatus required:

Robot studio Simulation software

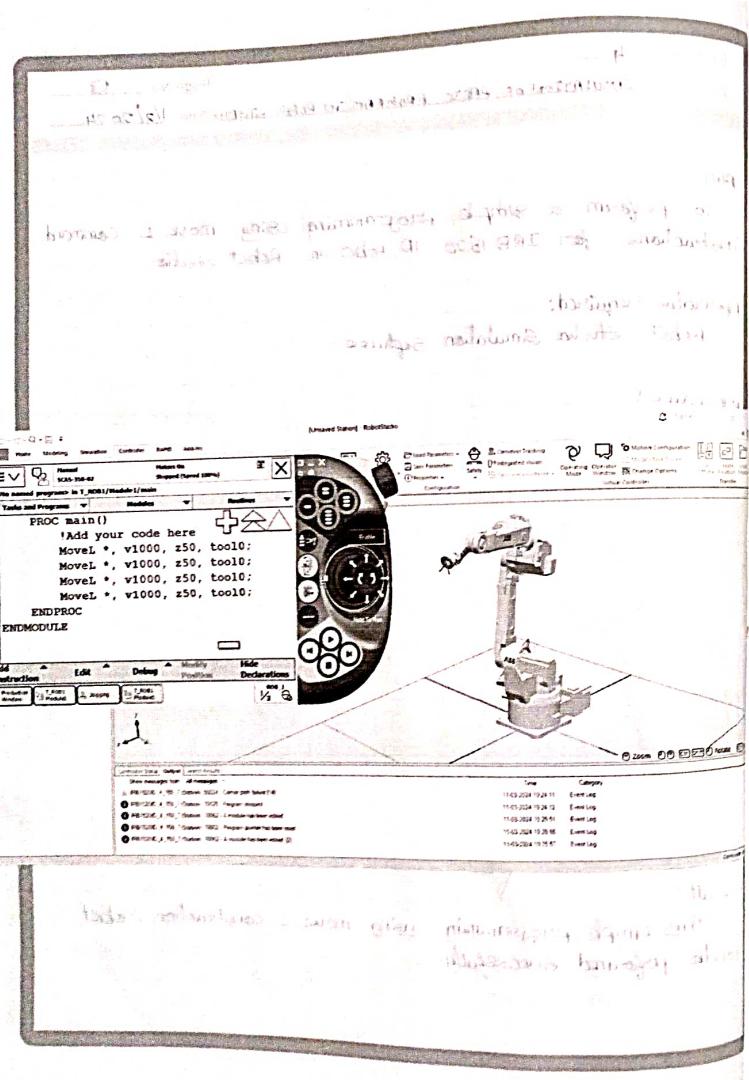
procedure:

- i) open IRB 1620 robot controller from virtual controller.
- ii) Open the floor pendant and turn it to manual mode.
- iii) open the program editor and start the program.
- iv) Select the move L command from add instruction section and modify the position.
- v) move the robot after modifying the position
- vi) play the simple program in auto mode.

POV

Result:

This simple programming using move L construction robot studio performed successfully.



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Expt. Name SIMULATION OF BASIC PROGRAM IRB1520 Date: 1/3/24

Aim:

To perform a simple programming using 'waitTime' command in IRB1520 robot in robot studio.

Apparatus required:

Robot studio simulation software.

Procedure:

- i) Open IRB1520 robot controller from virtual controllers.
- ii) Open the floor pendant and turn it to move L command.
- iii) Open the program editor and start the program.
- iv) After performing move'L' command add waitTime of 5 seconds.
- v) Play the simple program in autemode and verify.

Program:

```

PROC main()
    !Add your code here
    MoveL *, v1000, z50, tool0;
    ENDPROC
ENDMODULE

```

Result:

Thus the simple programming using waitTime command in IRB1520 robot has been successfully executed.

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Expt. Name Program using WAIT command

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Date: 14/12/

Aim:

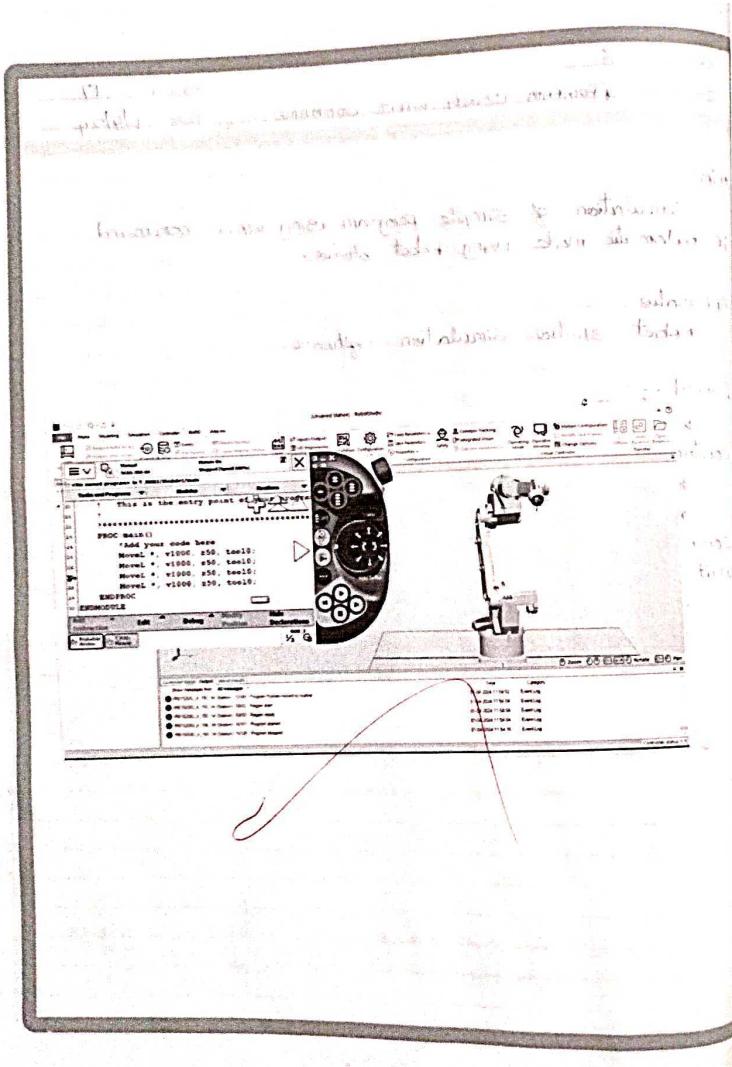
Simulation of simple program using WAIT command in Automate mode using Robot studio.

Apparatus:

Robot studio simulation software.

Procedure:

- * Open IRB 1520 robot controller from virtual controller.
- * Open the program editor and start the program.
- * After performing basic move L command add wait command from the add instructions section with a wait time of 10 Seconds.
- * Switch the teach pendant to automatic mode.
- * Play and Verify the program.



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Program:

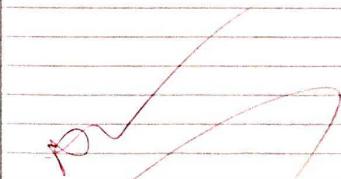
PROC main()

MOVE L1, V1000, Z250, TOOL0;
 WAITTIME 10;

MOVE L1, V1000, Z50, TOOL0;
 WAITTIME 10;

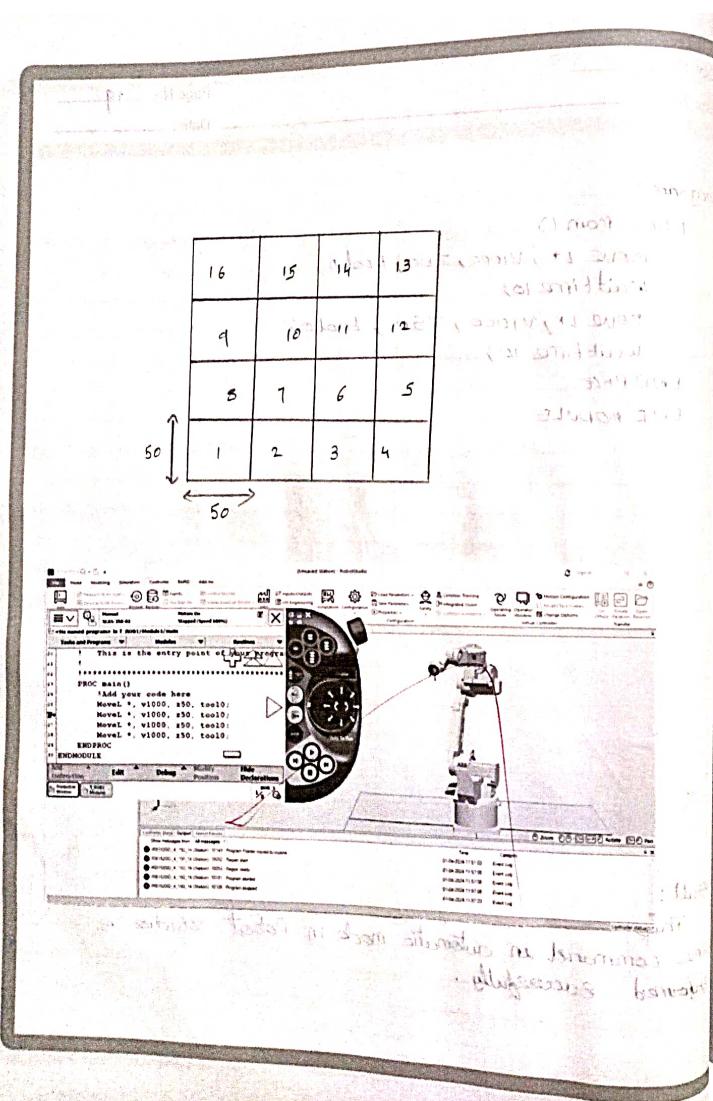
ENDPROC

ENDMODULE



Result:

Thus the simple programming by adding wait time command in automatic mode in Robot Studio is performed successfully.



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Expt. Name PALLETIZING OPERATION WITH IRB1520 Date: 14/04

Aim:

To perform simple program of palletizing operation in the given pallet with IRB1520 10 industrial robot.

Robot specification:

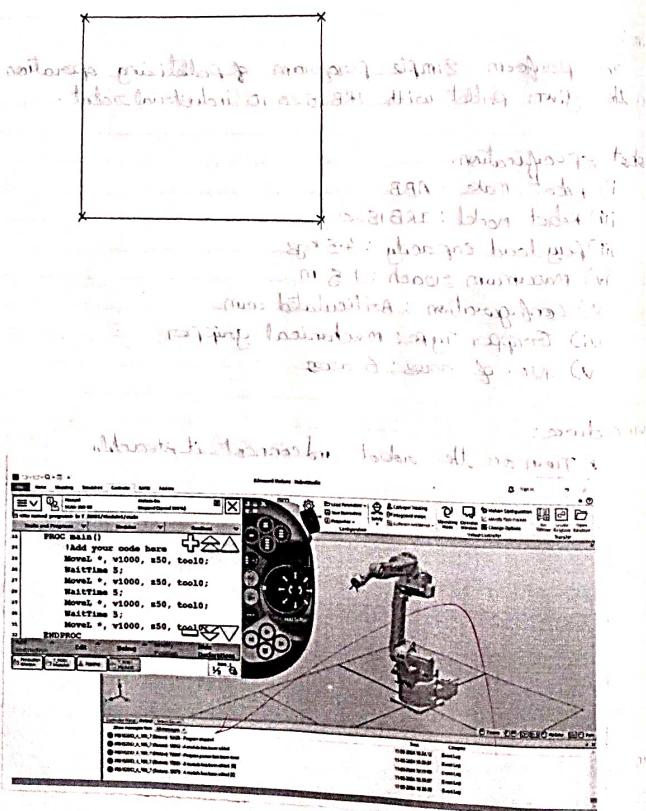
- Robot make : ABB
- Robot model : IRB1520
- Pay load capacity : 4.5 kg
- Maximum reach : 1.5 m
- Configuration : Articulated arm
- Gripper type : Mechanical gripper
- No. of axes : 6 axes

Procedure:

- * Turn on the robot and connect it steadily
- * For major axis:
 - use left and right for axis 1
 - use up and down for axis 2
 - use clockwise and anticlockwise for axis 3
- * For minor axis:
 - use left and right for axes 4
 - use up and down for axes 5
 - use clockwise and anticlockwise for axes 6.
- * use these functions to perform palletizing operation in the given pallet.

Result:

Thus the palletizing operation was performed successfully.



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Expt. Name PERFORMING SQUARE TRAINING OPERATION Date: 14/04

Aim:

Performing Square tracing operation in robot studio.

Apparatus:

Robot studio simulation software

Procedure:

- * open IRB1520 1D robot controller from virtual controller.
- * open the Program editor and start the program.
- * using move L command, modify the target positions of the end effector in such a way that it moves in a square tracing path.
- * switch the flex pendant to automatic mode.

Program:

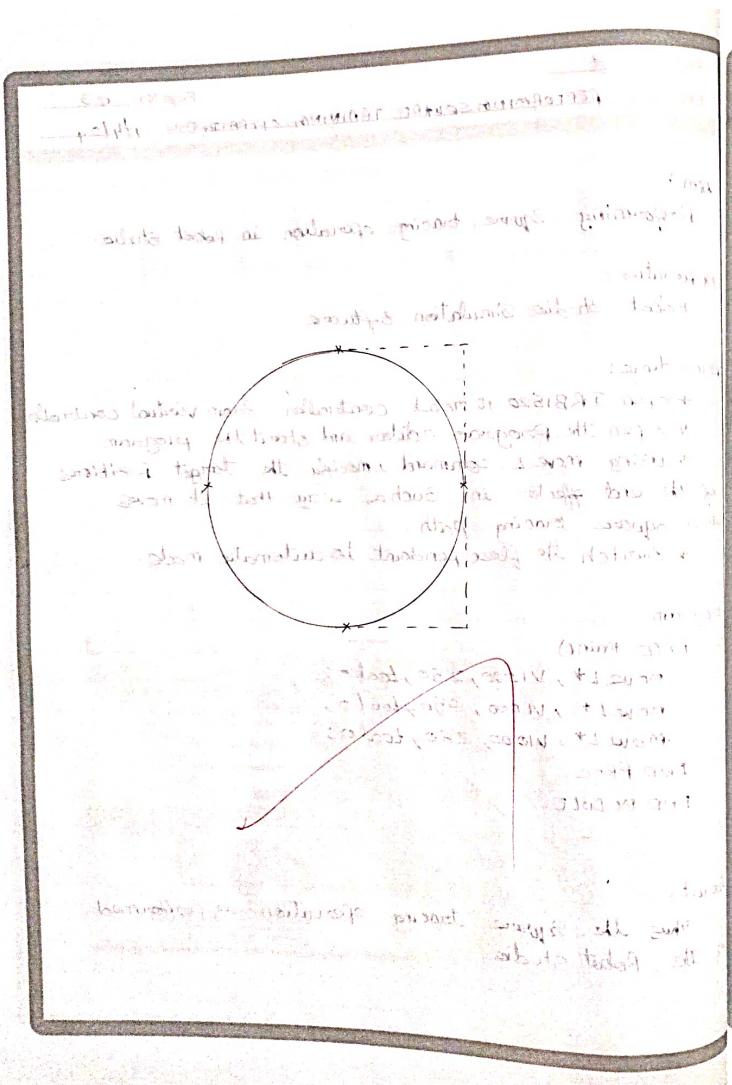
```

PROG Main()
    LADDER CODE HERE
    MOVE L v1000, z50, tool0;
    MOVE L v1000, z50, tool0;
    MOVE L v1000, z50, tool0;
    MOVE L v1000, z50, tool0;
END PROG

```

Result:

Thus the square tracing operation is performed in the Robot studio.



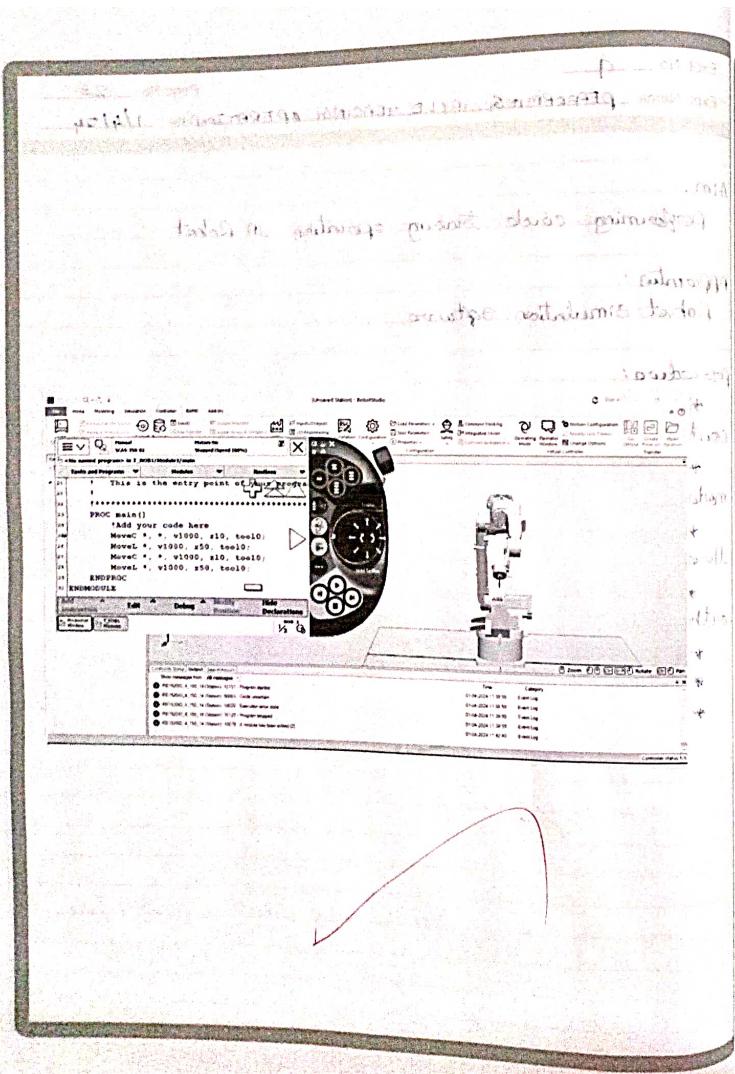
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 Expt. Name PERFORMING CIRCLE TRACING OPERATION Date: 1/4/24

Aim:
 Performing circle tracing operation in Robot

Apparatus:
 Robot simulation software.

Procedure:

- * open IRB1500 1D robot controller from virtual controller.
- * open the flex pendant and turn it to manual mode.
- * open the program editor and start the program there.
- * Modify the positions of the end effector in orthogonal position using moves.
- * Repeat the same steps to trace a complete circle.
- * Switch the flex pendant to automatic mode.
- * Play and verify the program.



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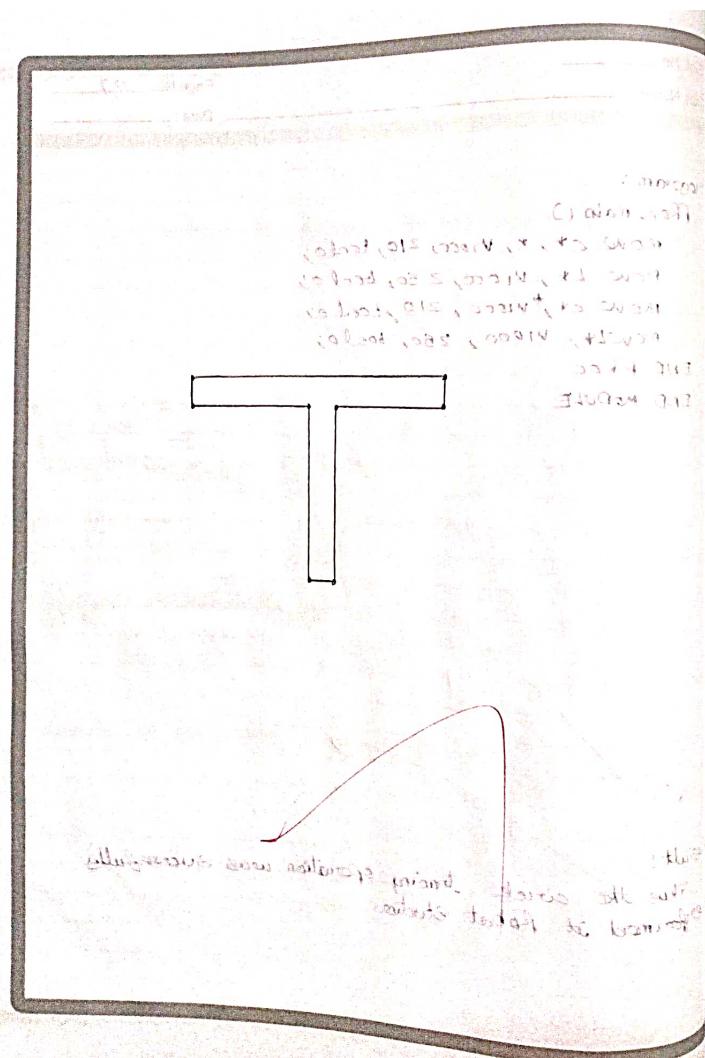
Program :

```

PROC main()
    ;Add your code here
    MoveC z+, v1000, z10, tool0;
    MoveL z+, v1000, z50, tool0;
    MoveC z+, v1000, z10, tool0;
    MoveL z+, v1000, z50, tool0;
ENDPROC
ENDMODULE

```

Result:
Thus the circle tracing operation was successfully performed at Robot Studio.



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Expt. Name <u>PERFORMING LETTER TRACING</u>	Date: <u>11/4/24</u>

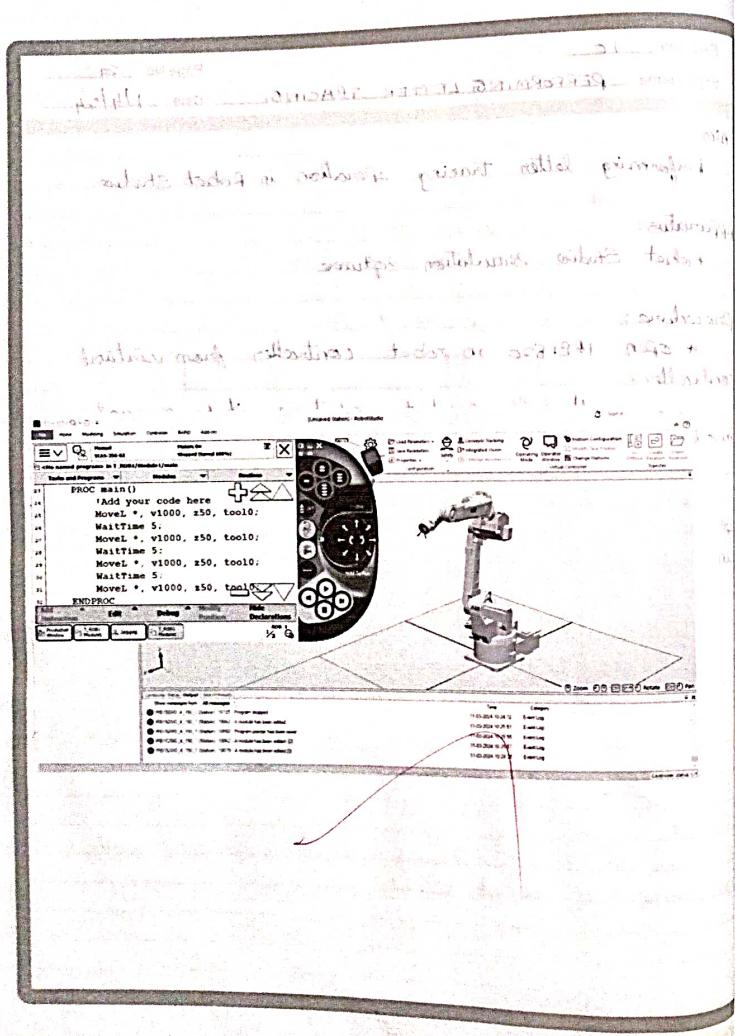
Aim:
Performing letter tracing operation in Robot studio

Apparatus:
Robot Studio simulation software

Procedure:

- * open IRB1520 in robot controller from virtual controller.
- * open the flex pendant and turn it to manual mode
- * open the program editor and start your program.
- * using move L command, modify the target positions of the end effector in such a way that it moves in path of the alphabet T.
- * Switch the flex pendant to automatic mode.
- * Play and Verify the program.

Diagram:
A red line representing the path of the robot's end effector as it traces the uppercase letter 'T'.



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Program:

```

Proc main()
    move L*, V1000, Z50, tool0;
    move L*, V1000, Z50, tool0;
    move L*, V1000, Z50, tool0;
    move L*, V1000, Z50, tool0;
ENDPROC
ENDMODULE
  
```

Result:
 Thus the training operation of the letter I in Robot studio was performed successfully.