Lab Number 14
Rhino XR4 Introduction and Basic Working

Introduction:

RHINO_XR4 operation is similar to an industrial Robot. Before starting further explanation of robot it there are some safety precautions and measures that are necessary to be taken in order toavoid accidents. These are:

- Safety
- Clear working area (range of robot movement) before turning on Robot.
- Emergency button should be immediately used in case of any irregular behavior shownby the robot

There are three zones defined, for operating a robot safely:

Zone1:

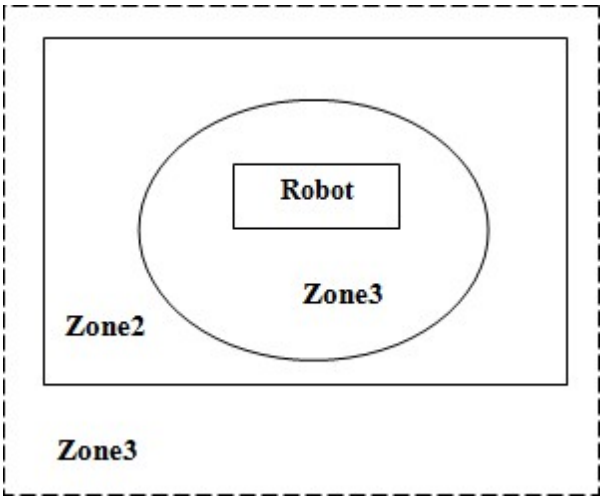
- Is also known free area
- Area outside work cell
- No restrictions on humans in this area
- No accident can occur here

Zone2:

- Thin margin between zone1 and zone3
- Area inside work cell
- Out of reach of robot

Zone3:

- Is also known as working area of robot
- Area inside work cell
- No one is allowed here in run mode of robot, else accident may occur



Diagrammatical view representing all the three Zones clearly forBetter understanding After understanding safety measure, now to start parts of robot, degrees of freedom, teachpendant, modes of operations and types of homes will be introduced.

Parts of RHINO-XR4 Robot:
Robot consists of following parts as given below along with brief introduction with each:

Mechanical Arm (mechanical part)

- Jointed spherical geometry
- Mechanical part
- 5 degrees of freedom altogether it will have, which include following parts:
- Waist (single motor)
- Shoulder(single motor)
- Elbow(single motor)
- Wrist(two motors one for Rotation , one for Flexion)
- All motors are DC servo motors with optical encoders so these motors are not directly attached through links or chains.
- Joints movement is because of motors attached (all the motors are labeled by alphabets on teachpendant).Motion is transferred from the axis drive motors to joints by chain mechanisms.

Computer based internal controller

- MARK-4 controller
- Internal microcomputer
- Operating system software
- Interfacing electronics

Tool gripper(end of arm tool)

- Electronically controlled gripper
- Has a motor for opening and closing of gripper
- Gripper actuated by DC servo motor is called parallel type gripper

Teach Pendant

- Handheld pendant
- Connected to controller through round cable
- 29 keys on pendant
- 13-keys are used for program develops
- 10-keys provide motion control
- 05-keys are used to modify other key functions

- LCD display with two lines 16-characters
- Also has an emergency stop button
    - Alphabets(from A to H) for representing DC servo motors

External storage devices (for example CD, USB, DVD and PC)

On robot ports are available for interfacing it with external device for programming it.

- Standard RS-232 C cable used for serial communication with PC
- 16-discrete input ports:
    i. 08 as switches
    ii. 02 auxiliary high power output 20volts
    iii. 12 volt power connector

External power source

- Main AC supply
- Power switch
- 120volts,60Hz
- 220volts,50Hz
- Pilot lamp

Modes of Operations:

There are four modes of operation for the robot. These are given below along with some explanation of each mode:

Play mode:

In this mode:

- Default mode of robot when it is turned on

- Manipulate arm without storing information
- Program resets when robot is reset

Edit mode:

- In this mode:
- Create a program
- Store a program
- Replay a program
- Edit a program
- Commands can be saved in this mode

Run mode:

In this mode:

- Plays and executes a program
- Replay any program

Host mode:

In this mode:

- Code is saved on any external device, so that it can be executed again at any time
- Transfer control to external or host controller

Types of homes:

There are two types of homes:

1. Hard home:
- Mechanical home position, which is determined by limit switches located on therobot joints
- Do it once before starting to program robot
- For doing hard home, press configuration key on teach pendant and then hardhome
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2. Soft home:
- Software home position
- Can be more than one
- Can be set at any time in the program

Understanding teach pendant:

Pendant program executes in a series:

Line no. Function (Error) mode

			Kernel command (messages)			

Position axis:-

- waist(F)
- shoulder(E)
- Elbow(D)

Orientation axis:-

- Flexion of wrist(C)
- Rotation of wrist(B)

PD command → tells pendant a new position
MC command → tells pendant to execute a move
G and H alphabets control auxiliary equipment

Procedure:

- Turn on the robot by plugging into AC supply
- Go to configure, select hard home
- Select motor example "F"
- Up and down keys are used to change orientation of the motor
- Speed of movement depends upon key actions, press once and releasing → 4 encoders count
- Press → release → press to achieve the required speed.
- Press ESC to escape from the step done
- Stop robot by bringing it to its hard home position