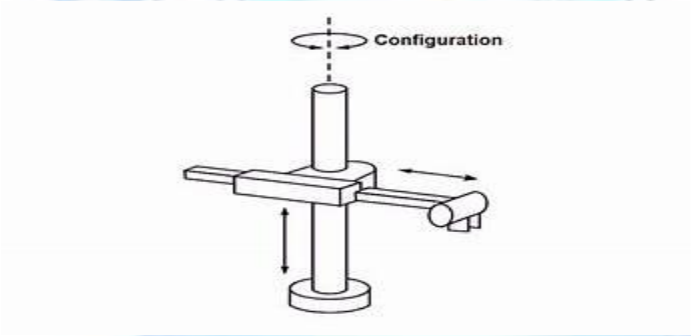
1.3 ROBOTICS CO-ORDINATE SYSTEM:

A coordinate system defines a plane or space by axes from a fixed point called origin. Robot targets and positions are located by measurements along the axes of coordinate systems. The robots are available in wide variety of sizes, shapes and physical configuration. The vast majority of today's commercially available robots possess one of four basic configurations.

1. Cylindrical Configuration
2. Polar Configuration
3. Joined Arm Configuration
4. Cartesian Co-ordinate Configuration

CYLINDRICAL CONFIGURATION:

It uses a vertical column and a slide that can be move up and down along the column. The robot arm is attached to the slide so that it can be moved radially with respect to the column. By rotating the column, the robot is capable of achieving a workspace that approximates a cylinder.



Advantages:

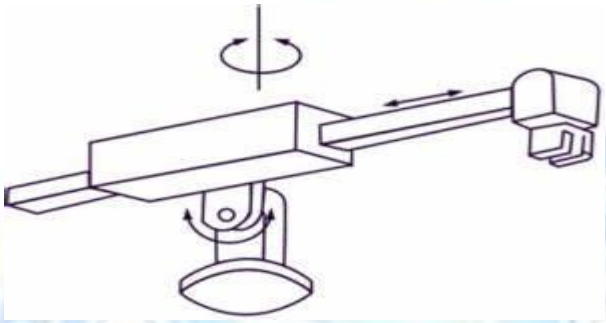
- Increased Rigidity
- Capacity of carrying high payload

Disadvantages:

- Floor space required is more
- Less work volume

POLAR CONFIGURATION:

It uses a telescopic arm that can be raised or lowered about a horizontal pivot. The pivot is mounted on a rotating base. These various joints provide the robot with the capability to move its arm within a spherical space and hence the name “spherical coordinate robot”.



Advantages:

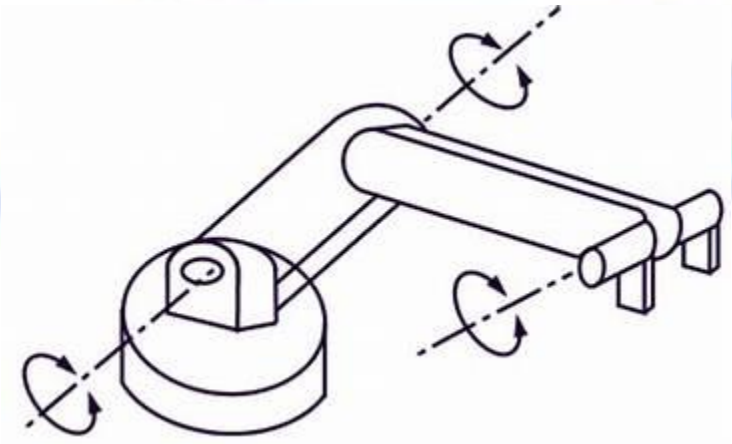
- Long reach capability in the horizontal position

Disadvantages:

- Vertical reach is low

JOINED ARM CONFIGURATION:

The arm in these configuration robots looks almost like a human arm. It is made up of rotating joints. This robot configuration is also sometimes called anthropomorphic as its anatomy is similar to human-arm.



Advantages:

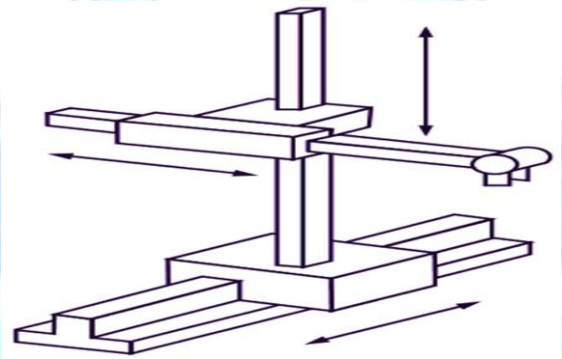
- Increased flexibility
- Huge work volume
- Quick operation

Disadvantages:

- Very expensive
- Difficult operating procedures
- Plenty of components

CARTESIAN CO-ORDINATE CONFIGURATION:

It uses three perpendicular slide to construct the X, Y, Z axes. Other names are sometimes applied to this configuration including XYZ robot and rectilinear robot. By moving the three slides relative to another, the robot is capable of operating within a rectangular work envelope.



Advantages:

- Fewer cost
- Simple operating procedures
- High payloads

Disadvantages:

- Less work envelope
- Reduced Flexibility

1.5 WORK ENVELOPE:

The work envelope (or workspace) in robotics refers to three-dimensional space within which a robot can operate or move its end-effector (tool, gripper or sensor). It defines robots maximum reach and limits of motion. The convention of using the wrist end to define the robots work volume is adopted to avoid the complication of different sizes of end-effectors that might be attached to the robot's wrist. End effector is an addition to the basic robot and should not be counted as a part of the robots working space. Also, the end effector attached to the wrist might not be capable of reaching certain points within the robot's normal work volume because of the particular combination of joints limits of the arm.

The work volume is determined by the following physical characteristics of the robot:

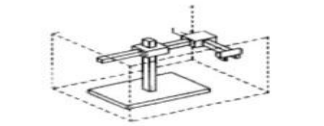
- The robot's physical configuration (type of joints, structure of links).
- The sizes of the body, arm and wrist components.
- The limits of the robot's joint movement.

Types of Robots and their work envelope:

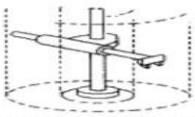
Cartesian	Rectangular Box
SCARA	Cylindrical
Cylindrical	cylindrical
Polar	spherical

Importance of Work Envelope:

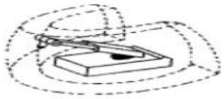
1) Planning: Helps in layout design of robot work cell.
2) Safety: Defines boundaries to prevent collision.
3) Efficiency: Ensures tasks are within the robot's operational area.
4) Selection: Important factor when choosing the right robot for a specific application



Rectangular Coordinate Robot

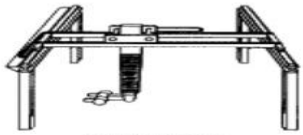


Cylindrical Coordinate Robot

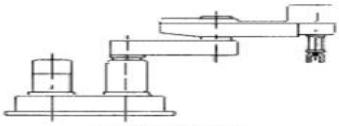


Sperical Coordinate Robot

Articulated Arm Robot



Gantry Robot



SCARA Robot