

- Anthropomorphic : Human life.
- Automation is required for hazardous applications.

* Robotics : In general, "It is a special type of computer control machine that can perform wide variety of task."

→ First definition of robot given by Computer aided manufacturing international (CAM-I) U.S.A. It states that,

"A robot is a device that perform functions ordinarily ascribed to human beings, or operates with what appears to be almost human intelligence."

→ Second definition of robot given by Robotics institute of America (RIA) U.S.A. It states that,

"A Robot as a programmable multi-function manipulator design to move material, parts, tools or a special devices through variable programmable motion for the performance of variety of task."

Industrial Robotics : An industrial robot is a general purpose programmable machine possessing certain anthropomorphic feature.

→ The most obvious anthropomorphic feature is the robot's mechanical arm.

A dedicated robot need 6 axes (Extra 3 on end effector)

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⇒ Tasks performed by Robots in factories are:

(i) Movement of material on shop floor.

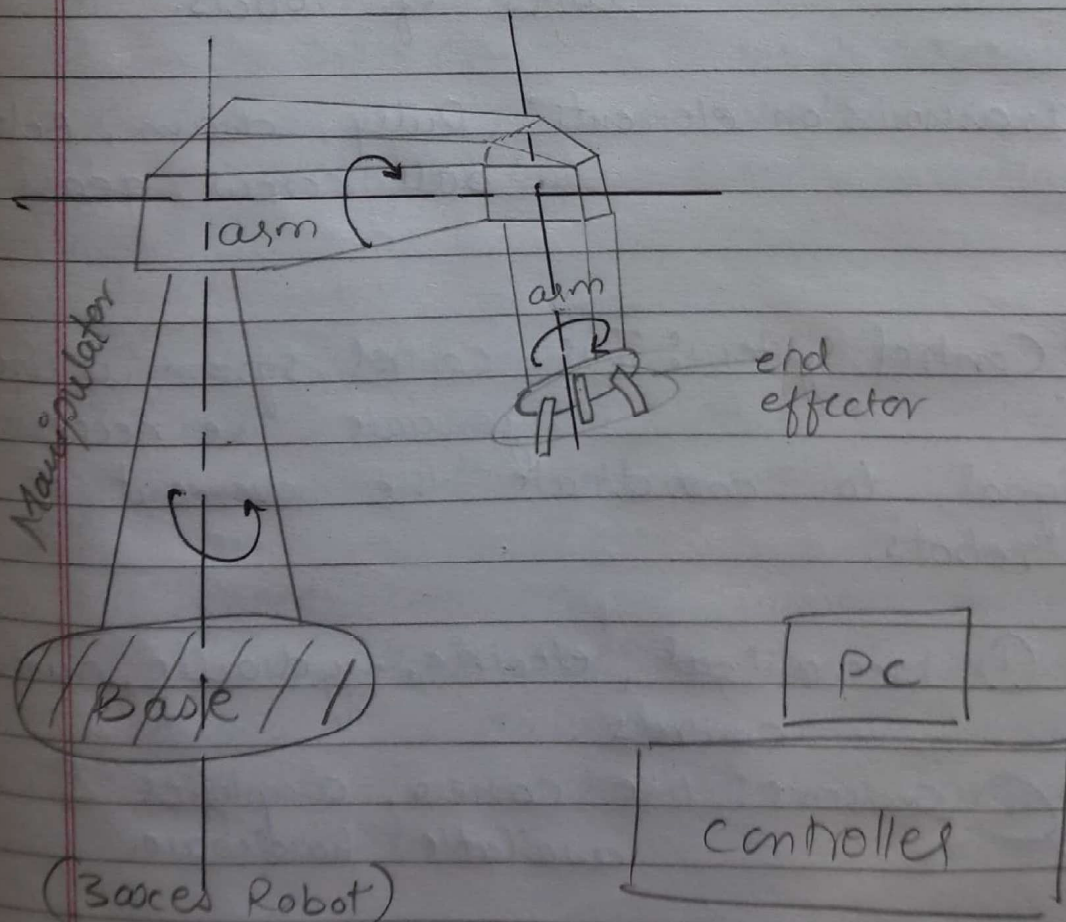
(ii) Automated Guided Vehicle (AGV)
or Rail Guided Vehicle (RGV)

(iii) Loading & unloading of components.

(iv) Inspection using vision sensor

(v) Manufacturing operation like painting, welding, marking, automatic assembly etc.

★ Elements of Robotics system.



A robot is a system made up of several elements of hardware & software, includes;

(A) Robotic manipulator:

(i) A manipulator: - Base & arm assembly
- It consist of a series of link-joint-link combination (either linear or rotatory joint they are).

(ii) End of arm tooling: - Gripper & end effector

(iii) Actuator: - Motor or drives, that moves the links of robots.

(iv) Transmission elements: Pulley, chain, Belts, ball screw, gears etc.

(B) Control system:

The control system is use to generate the neccessary signal to coordinate the movement of robots.

(i) Mechanical, electric, hydraulic, pneumatic controls

(ii) Sensors: like camera, amplifiers & available hardware.

(iii) Equipment interface

(c) Computer System: This provides the data processing capability to interpolate the intermediate position & control the movement of links or robotic arms.

(d) Microprocessor or Programmable logic control (PLC)

(iv) User interface: Keyboard, teach pendant, display.

* Need for using robots: Robots are used increasingly in manufacturing industries for many reasons.

(i) Robots can be built with performance capabilities superior to those of human beings in terms of strength, size, speed, accuracy & repeatedly.

(ii) Robots are better than humans to perform simple & repetitive task with better quality & consistency.

(iii) Robots can replace human in performing task that are difficult & hazardous due to size, weight, environment (heat, dust, chemical, nuclear radiation & pollution).

- (iv) Robots do not have the limitation & negative attributes of human being or human workers. like, fatigue, need for rest, energy drink & refreshment.
- (v) Robots can lower the cost through reduction in uses of material through their efficiency.
- (vi) Robots become more economical as labour cost increase at higher pace.

→ Although they may have many advantages they are not always the best choice for all manufacturing application. Even though they may have wide variety of capabilities, they still can not match the unique combination of mental skill & attention physical dexterity of human operator.

However, Robots can supplement human operators to enhance their productivity.

★ Manipulator design :

3 axis : Base & arm assembly

3 axis : End effector (Roll, Yaw, Pitch) (wrist assembly)

A Robot Manipulator can usually be divided into two sections,

- (i) Base & arm assembly (body & arm assembly)
- (ii) Wrist & arm assembly

— There are different 3 joints associated with body and arm assembly and two or three joints associated with wrist.

— The function of arm & body is to position an object or tool.

— Positioning is concerned with moving the part/tool or object from one location to another.

— Orientation is concerned with precisely aligning the object relative to some stationary location.

— The arm & body consist of large link and joint the wrist consist of short link.

— The arm and body joint often consists of both linear and rotating types while the wrist joint are almost rotating types.

These are 3 joints of wrist motion:

- (i) Roll: Rotational / survival motion or movement in a plane \perp to the end of arm.
- (ii) Pitch: Rotational or bending movement in a plane vertical to the arm.
- (iii) Yaw: Rotational or twisting movement in a plane horizontal to the arm.

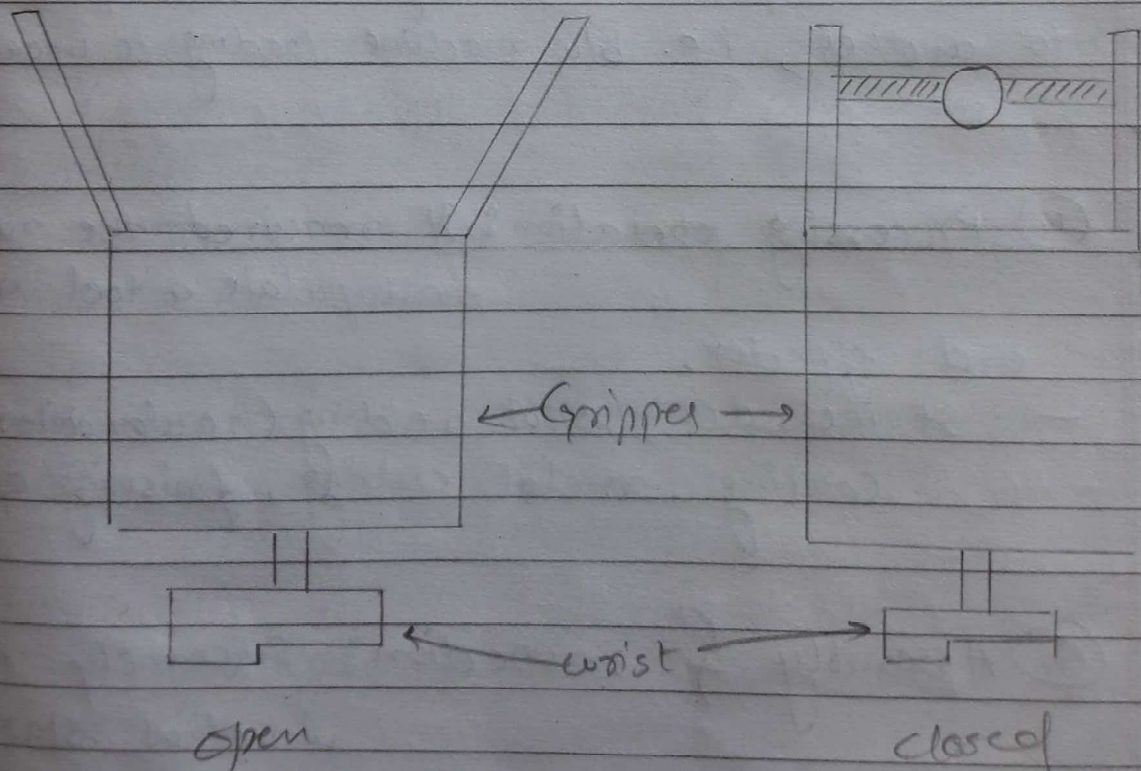
Application of industrial robot:

Robot are being used for a wide variety of task in industries. A study of application wise rise breakup with industrial robots in USA & Japan

App.	USA	Japan
Welding	35%	28.5%
Material handling	26%	27.5%
Casting	8%	9%
Loading	5%	3.5%
Painting	16%	2.6%
Other	10%	5.5%

End effector: It is a special tool that connects to the robots wrist for performing special tasks.

Gripper: Grippers are designed to grab and move object, during work cycle. The objects are usually work parts.
— They are used for part placement application, machine loading & unloading.



Application of industrial robots:

- (i) Working environment is hazardous for human.
- (ii) Workcycle is repetitive.
- (iii) Part/tool handling would be difficult for human.
- (iv) Multishift operation.
- (v) Long production run & infrequent change over.

— App. of industrial robots can be divided in three basic categories;

(i) Material handling: It involve the movement of material from 1 location to another, i.e. b/w machine loading to unloading etc.

(ii) Processing operation: It required the robot to manipulate a tool as its end effector.

— It includes, spot welding (in automobiles), spray coating, metal cutting, finishing operation.

(iii) Assembly & inspection: Assembly operation involves staking of one part onto another part.

— Inspection oper. sometimes required the robot to position a work part relative to an inspection device or to load a part into an inspection machine.