

# Robot Components and Configurations

# Robot Components

- Power Supply
- Actuators
- Electric motors
- Sensors
- Controller

# WHAT IS ROBOTICS...?

Robotics is science of designing or building an application of robots. Simply ,Robotics may be defines as “The Study of Robots”. The aim of robotics is to design an efficient robot.

## WHY IS ROBOTICS NEEDED...?

Robotics is needed because:–

- Speed
- Can work in hazardous/dangerous temperature
- Can do repetitive tasks
- Can do work with accuracy



# Types of Robots



- The types of robots are: -
- 2) Mobile robots.
- 3) Industrial robots
- 4) Autonomous robots
- 5) Remote-controlled robots.
- 6) Virtual robots.

# Mobile Robots



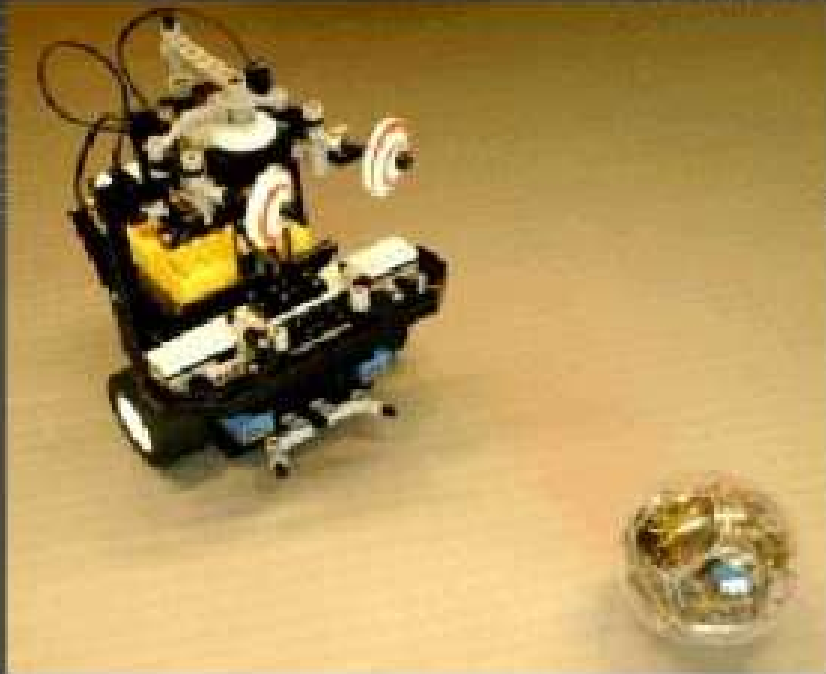
- Mobile robots are able to move, usually they perform tasks such as searching.
- They are of 2 types: -
  - 3) Rolling robots- Rolling robots have wheels to move around. They can quickly and easily search. However they are only useful in flat areas.
  - 4) Walking robots- Robots on legs are usually brought in when the terrain is rocky. Most robots have at least 4 legs; usually they have 6 or more.

# Industrial Robots



- Most of these robots perform repeating tasks without ever moving.
- Most robots are working in industries. Especially dull and repeating tasks are suitable for robots.
- A robot never grows tired; it will perform its duty day and night without ever complaining.

# Autonomous Robots



- Autonomous robots are self-supporting.
- They run a program that gives them the opportunity to decide on the action to perform depending on their surroundings.
- At times, these robots even learn new behavior. They start out with a short routine and adapt this routine to be more successful at the task they perform. The most successful routine will be repeated .

# Remote-controlled Robots



Dante 2, a NASA robot designed to explore volcanoes via remote control.

- In case a robot needs to perform more complicated yet undetermined tasks an autonomous robot is not the right choice.
- Complicated tasks are still best performed by human beings with real brainpower. A person can guide a robot by remote control. A person can perform difficult and usually dangerous tasks without being at the spot where the tasks are performed.



# Virtual Robots



- Virtual robots don't exist in real life. Virtual robots are just programs, building blocks of software inside a computer.
- A virtual robot can simulate a real robot or just perform a repeating task.
- Search engines use such kind of robots. They search the World Wide Web and send the information to the search engines.

# Robot Anatomy

- Robot anatomy is concerned with the physical construction of the body, arm, and wrist of the machine.
- Most of the robots used in plants today are mounted on base which is fastened to the floor.
- The body is attached to the base and arm assembly is attached to the body.
- At the end of the arm is wrist.

# Robot Anatomy

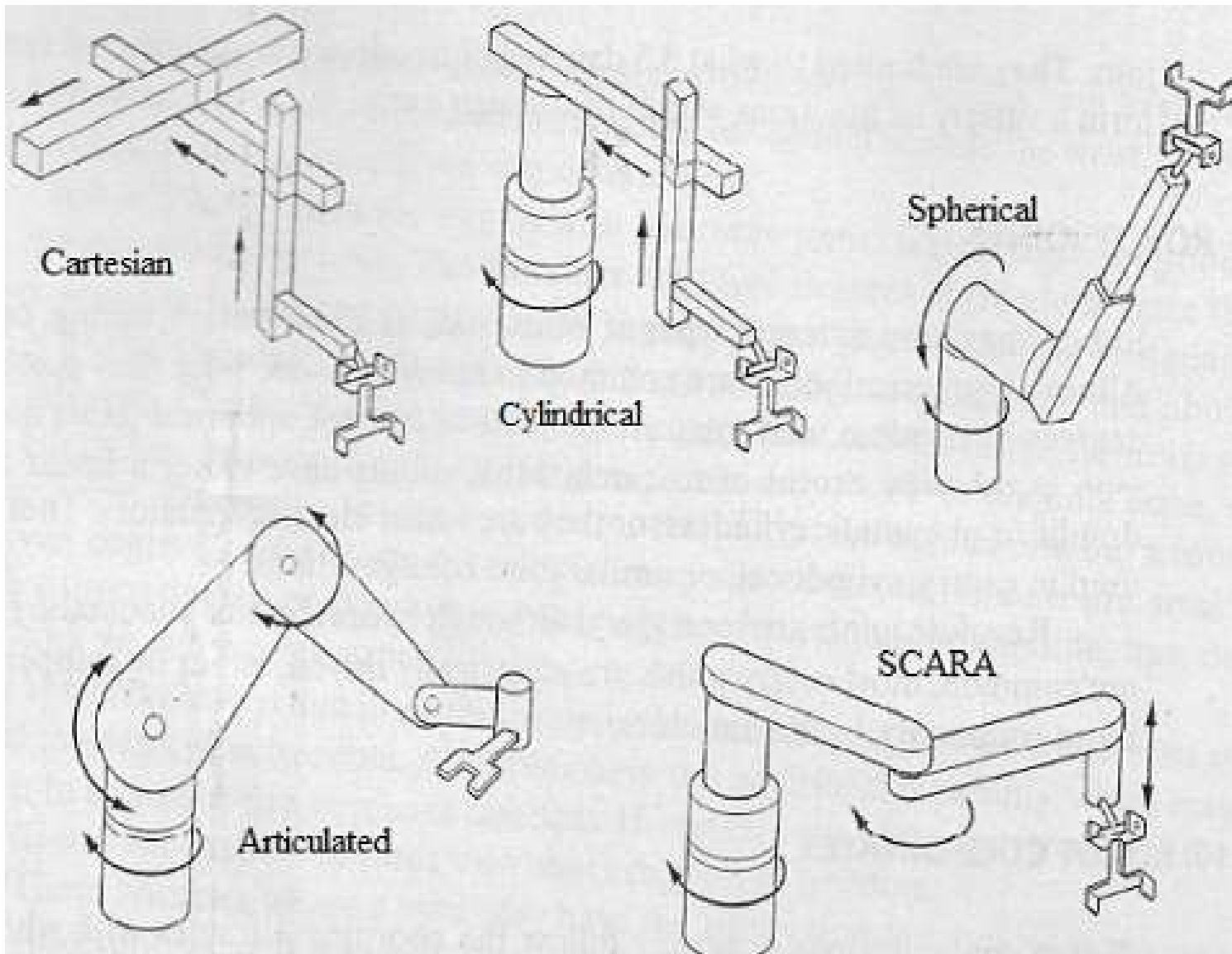
- The wrist of robot consists a number of components that allow it to be oriented in variety of positions.
- The body, arm and wrist assembly is sometimes called the manipulator.
- Attached to the robot's wrist or a tool called the “end effector”

# Robot Configurations

The industrial robots are available in wide variety of sizes, shapes and physical configurations.

## Robot Arm Configurations:

- Cylindrical S
- Spherical/Polar
- Articulated
- SCARA (Selective Compliance Articulated Robot Actuator)



# Cartesian

- Cartesian robots are perhaps the easiest and least expensive robots to build.
- Due to their rigid structure they can manipulate high loads so they are commonly used for pick-and-place operations, machine tool loading, in fact any application that uses a lot of moves in the X,Y,Z planes.
- These robots occupy a large space, giving a low ratio of robot size to operating volume. They may require some form of protective covering.

# Cylindrical

- Cylindrical robots are not widely used today.
- They have a rigid structure, giving them the capability to lift heavy loads through a large working envelope, but they are restricted to area close to the vertical base or the floor.
- This type of robot is relatively easy to program for loading and unloading of palletized stock, where only the minimum number of moves is required to be programmed.

# Articulated Arm

- Articulated robots are widely used in industry today. They are very versatile and are the most common robot configuration used in manufacturing industries today.
- This is the most widely used arm configuration because of its flexibility in reaching any part of the working envelope.
- This configuration flexibility allows such complex applications as spray painting and welding to be implemented successfully.



# SCARA

- SCARA (Selective Compliance Articulated Robot Actuator) robot configurations are extremely fast and are frequently used in electronics assembly applications.
- Although originally designed specifically for assembly work, these robots are now being used for welding, drilling and soldering operations because of their repeatability and compactness.

# Control System

- A robot must have a *control system* which is used to move the arm, wrist, and body of a robot at various paths. When different industrial robots are compared with their control system, they can be divided into four major types.

They are:

- Limited Sequence Robots
- Playback Robots with Point – Point Control
- Playback Robots with Continuous Path Control
- Intelligent Robots

# Limited Sequence Robots

- The limited sequence robots are incorporated with the *mechanical stops* and *limit switches* for determining the finishing points of its joints.
- These robots do not require any sort of programming. As a result, every joint can only travel to the intense limits.
- It is considered as the smallest level of controlling, and it will be best for simple operations like pick & place process.

# Playback Robots

- The playback robots are capable of performing a task by *teaching* the position. These positions are stored in the memory, and done frequently by the robot. Generally, these playback robots are employed with a *complicated* control system.

**It can be divided into two important types, namely:**

- Point to Point control robots
- Continuous Path control robots

# Playback Robots with Point – Point Control

- The point to point robots are shortly called as *PTP*.
- The desired paths are taught and stored in the control unit memory. These robots do not move from the desired location for controlling its path.
- It can be moved in a *small distance* only with the help of programming.
- This type of robots can be used for spot welding, loading & unloading, and drilling operations.
- Records work cycle as a sequence of points, then plays back the sequence during program execution.

# Playback Robots with Continuous Path Control

- The continuous path control is also known as *CP* control.
- These robots commonly move in the *straight line*.
- The initial and final point is first described by the programmer, and the control unit defines the individual joints. This helps the robot to travel in a straight line
- It can also move in a *curved path* by moving its arm at the desired points.
- Greater memory capacity and capability to execute paths (in addition to points).

# Intelligent Robots

- The intelligent robots can play back the defined motion, and can also work according to their environment.
- The sensor is incorporated in these robots for receiving the information during the process.
- This kind of robots is capable of communicating with the programmers in the work volume. It will be best for assembly purposes.