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# An Overview of Robotic Mechanical System

## 1.1 > Introduction

System → "Combinations of Parts forming a Complex whole"

Dynamic System → "It is a System in which one can distinguish three elements, namely, a State, an Input and an Output."

Mathematical model of the dynamic System ←  $\begin{matrix} \nwarrow \\ \nearrow \end{matrix}$   $\left( \begin{matrix} \text{Rule of transition from} \\ \text{one Current State to a} \\ \text{Future one.} \end{matrix} \right)$

⇒ State of a dynamic system at a certain instant is determined not only by the value of the input at that instant, but also by the past history of the input.

↳ Due to this dynamic systems are said to have memory.

Static System → System whose state at a given instant is only function of the input at the current time.

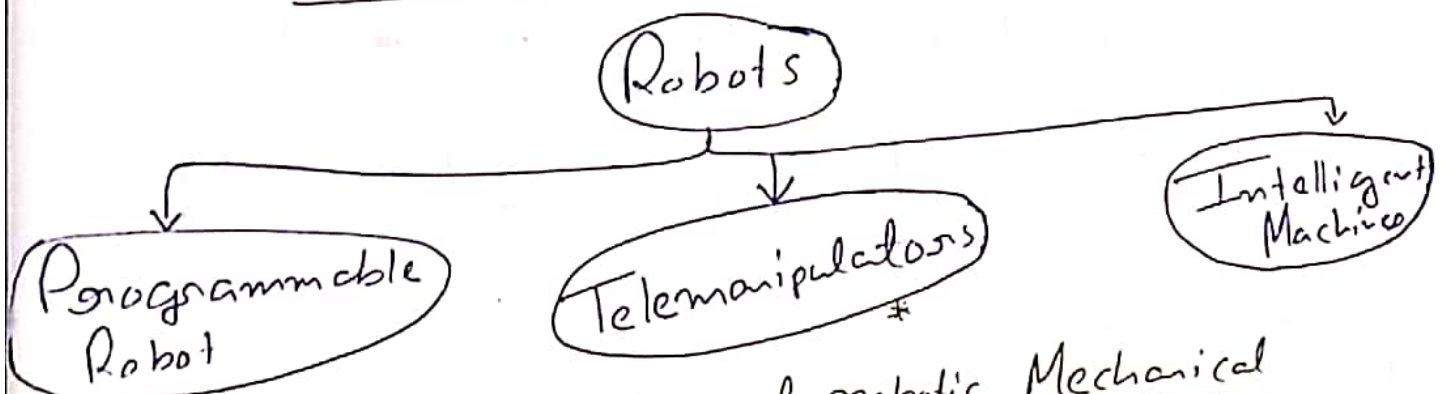
↳ They are said to have no memory.

## Programmable robot

→ Operation is limited to structured environments.

## Intelligent Robot

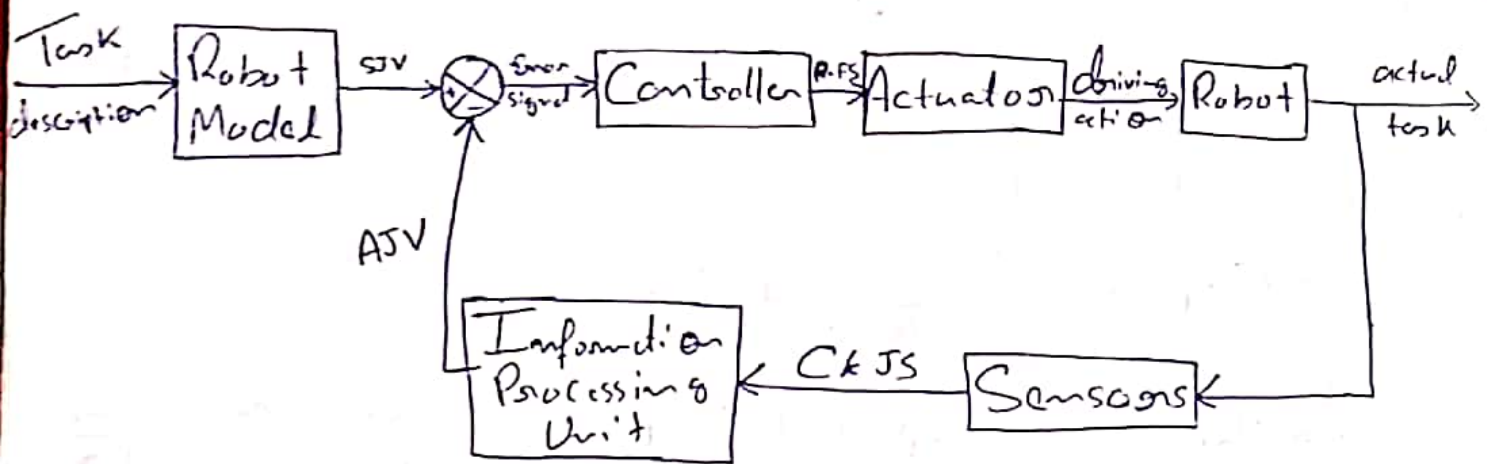
- Capable of reacting to Unpredictable Changes in an unstructured environment.
- They are expected to perceive their environment and draw conclusions based on this perception.
- By far most complex of perception tasks is Visual.



### 1.2) The general structure of robotic Mechanical System

⇒ A robotic mechanical system is composed of a few subsystem:-

- (i) Rigid & deformable bodies.
- (ii) Sensing subsystem.
- (iii) Actuation subsystem.
- (iv) Controller
- (v) Information-processing subsystem.



SJV  $\Rightarrow$  Synthesized joint variables (angles & torques)

P&FS  $\Rightarrow$  Position & force signals.

CKJS  $\Rightarrow$  Cartesian & Joint signals

ASV  $\Rightarrow$  Actual joint variables (angles & torques)

## Block diagram of a general robotic mechanical system

### Telemanipulators

Robotic mechanical system with a human being in their control loop.

### 1.3) Serial Manipulator

$\rightarrow$  They are simplest of all robotic mechanical systems.

$\Rightarrow$  A manipulator, in general is a mechanical system aimed at manipulating objects.

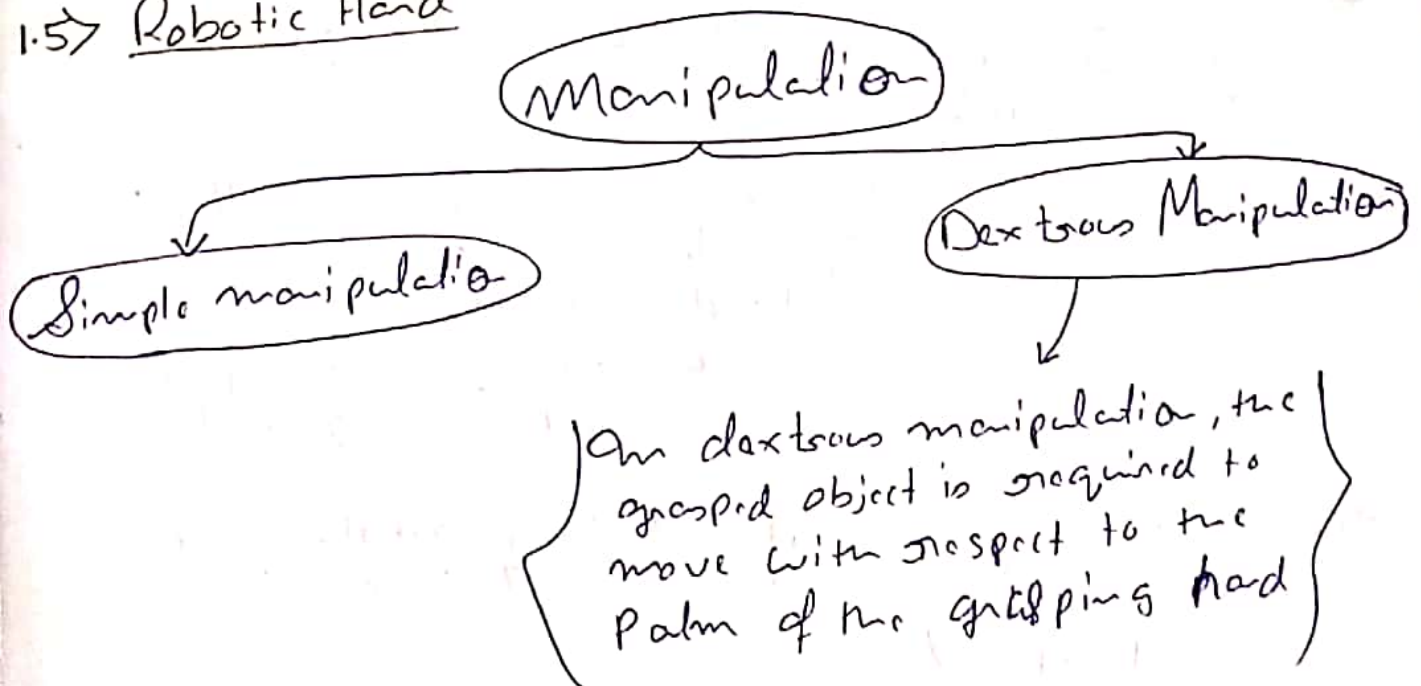


## 1.4) Parallel Manipulator

- ⇒ In a parallel manipulator, we distinguish one base platform, one moving platform, and various legs.
- ⇒ Contrary to Serial manipulators, all of whose joints are actuated, parallel manipulators contain unactuated joints.
  - ↳ The presence of unactuated joints makes the analysis of parallel manipulators, in general, more complex than that of their Serial counterparts.

### Example

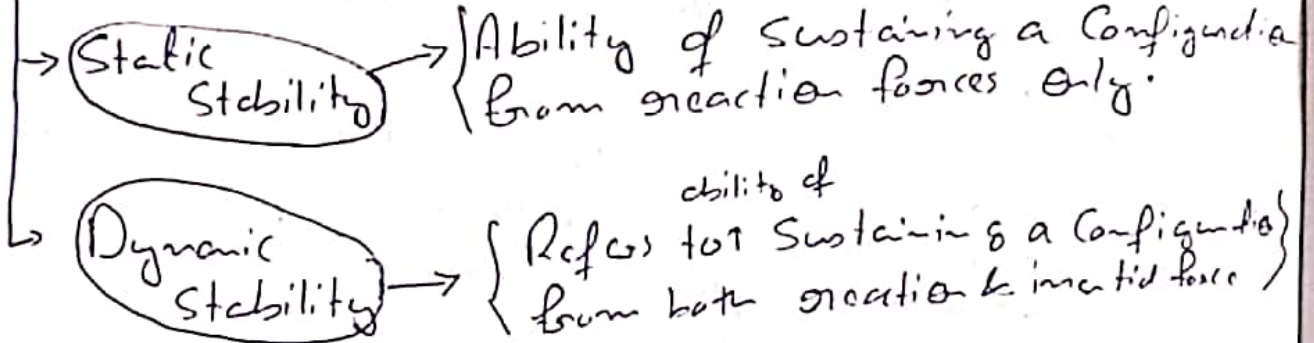
- ① Delta robot
  - ② Hexa robot
  - ③ Star robot
  - ④ Truss arm
- 1.5) Robotic Hand



## 1.6) Walking Machines

⇒ In walking machines, stability is the main issue.

### Stability



## 1.7) Rolling Robot

⇒ Parallel or Serial manipulator, they all have very limited workspace.

⇒ Manipulators with limited workspaces can be enhanced by mounting them on rolling robots.

⇒ Rolling robots are systems evolved from earlier systems called automatic guided vehicles (AGV).

→ { These vehicles are usually limited to motion along predefined tracks that are either railways or magnetic strips glued to the ground }

⇒ As a means to supply rolling robots with 3-dof capabilities, omnidirectional wheels have been proposed.

ex ⇒ Mecanum Wheel

⇒ Recent developments in the technology of rolling robots have been reported that incorporate of alternate type of ODW.

↳ Orthogonal ball wheels

