Securing your Future with your own Hands

UNIT 1 : Introduction To Robotics

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SEMESTER 5

Syllabus:

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1.1	Evolution of Robots & Robotics, Laws of Robotics, Progressive advancement in robotics, Definition of Robots
1.2	Types of Robots, Selection of Robot- Payload, Speed, Reach
1.3	Major Parts of Industrial robot

What is Robot & Robotics?

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Machines that can replace human beings as regards to physical work and decision making are categorized as robots and their study as robotics.

Why Robots?

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The industry is moving from the current state of automation to Robotization to increase productivity and to deliver uniform quality.

Where it is used?

Robots and robot-like manipulators are now commonly employed in hostile environment such as :

- Atomic plant for handling radioactive materials.
- To construct and repair space stations and satellites.
- In nursing and aiding patients.
- Micro-robots are designed to damage control inside human veins.
- Heavy earth-moving equipment.

1.1 Evolution of Robots & Robotics

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- Czech writer, Karel Capek, in his drama, introduced the word robot to the world in 1921.
- Czech word – Robota : Forced Laborer.
- Isaac Asimov – Russian S/f writer – coined the word Robotics in his story “Runaround”, published in1942.

Evolution of Robots & Robotics

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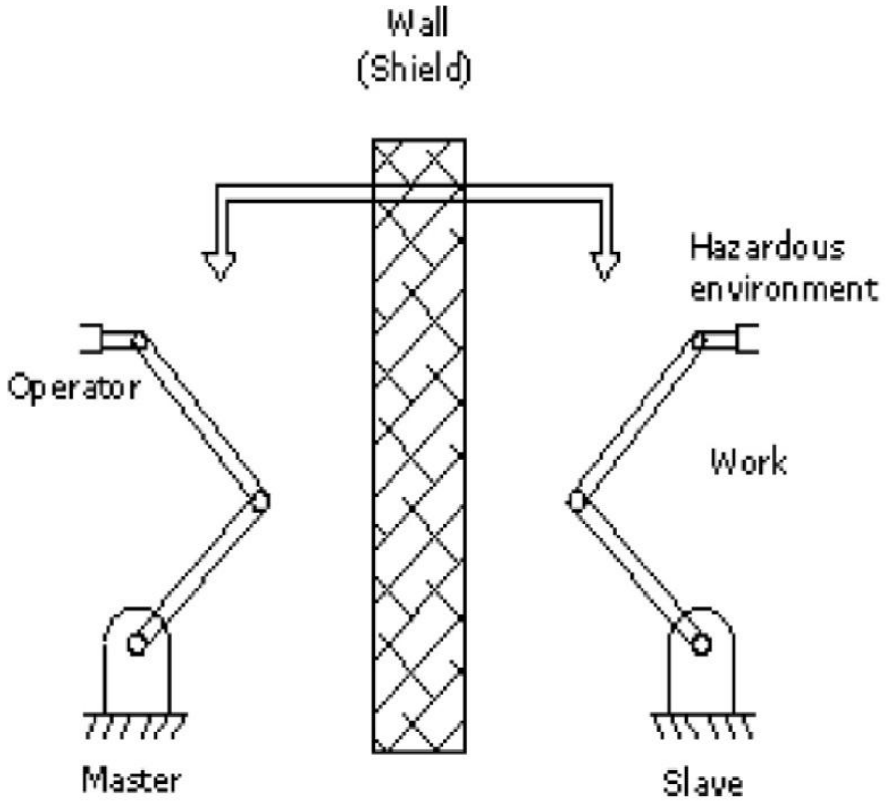
- The best record is of Joseph Jacquard's use of punched cards in mechanical looms, which laid the foundations for NC, CNC, and automats, in addition to robotics.



Master – slave Manipulator

Industrial robots are increasingly used in

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- Manufacturing plants
- Medical surgery and
- Rescue efforts

They require more difficult technology as much:

- Higher degree of accuracy
- Repeatability
- Flexibility and
- Reliability

Industrial robots are needed in :

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Robotics today is dealing with R&D in a number of interdisciplinary areas including :

- Kinematics and dynamics
- Control and motion planning
- Sensing
- programming
- machine intelligence

Laws of Robotics

Issac Asimov developed the robots as humanoids, devoid of feelings and used them in a number of stories.

His robots were well-designed, fail-safe machines, whose brains were programmed by human beings.

- **Law 1**

  A robot should not injure a human being or, through inaction, allow a human to be harmed.

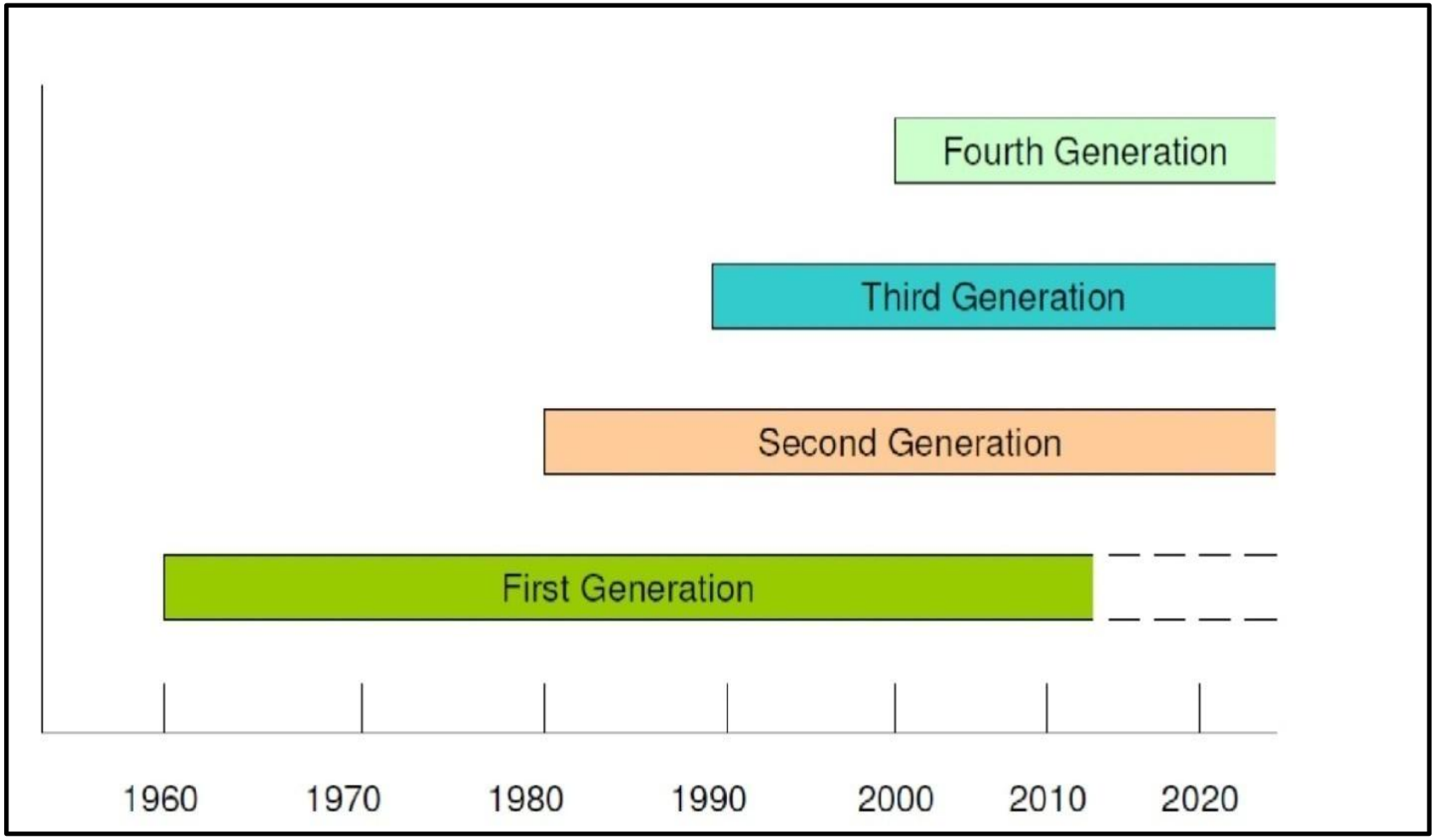
- **Law 2**

  A robot must obey orders given by humans except when that conflicts with the First Law.

- **Law 3**

  A robot must protect its own existence unless that conflicts with the First or Second Law.

Progressive Advancement In Robots



Progressive Advancement In Robots

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- The growth of robots can be grouped into robot generations, based on characteristic breakthroughs in Robot's capabilities. These generations are overlapping and include futuristic projections.

- **First Generation:** The First Generation robots are repeating, non-servo, pick-and-place, or point-to point kind. The technology for these is fully developed and at present about 80% robots in use in the industry is of this kind. It is predicted that these will continue to be in use for a long time.

Progressive Advancement In Robots

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Second Generation:

- The addition of sensing devices and enabling the robot to alter its movements in response to sensory feedback marked the beginning of second generation.
- These robots exhibit path control capabilities.
- This technological breakthrough came around 1980.

Progressive Advancement In Robots

Third Generation:

- The 3rd generation is marked with robots having human-like intelligence.
- The growth in computers led to high-speed processing of information and, thus, robots also required AI(artificial intelligence), self-learning and conclusion-drawing capabilities by past experiences.

Progressive Advancement In Robots

Third Generation:

- On-line computations and control, artificial vision and active force/torque interaction with the environment are significant characteristics of these robots.
- This technology is still in infancy and has to go a long way.

Progressive Advancement In Robots

Fourth Generation:

- This is futuristic and may be a reality only during this millennium.
- Prediction about its features is difficult, if not impossible.
- It may be a true android or artificial biological robot or a super humanoid capable of producing its own clones.
- This might provide for fifth and higher generation robots.
- The pictorial visualization of these overlapping generations of robots is given in below figure

Definitions of robot:

"An automatic apparatus or device that performs functions ordinarily ascribed to humans or operates with what appears to be almost human intelligence"

-Webster's Dictionary

Definitions of robot:

Japan Industrial Robot Association (JIRA) and the Japanese Industrial Standards committee define the industrial robot at various levels as:

- **Manipulator***:* a machine that has functions similar to human upper limbs an moves the objects spatially.

- **Playback robot***:* a manipulator that is able to perform a operation by reading off the memorized information for an operating sequence, which is learned beforehand.

- **Intelligent *robot***: a robot that can determine its own behavior and conduct through its functions f sense and recognition

Definitions of robot:

- A robot is a re-programmable, multifunctional manipulator designed to move material, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks" **-Robot Institute of America (RIA)**

- "A re-programmable device with minimum of four degrees of freedom designed to both manipulate and Transport parts, tools, or specialized manufacturing implements through variable programmed motions for Performance of specific manufacturing task." **- British Robot Association (BRA)**

Definitions of robot :

- “An industrial robot is an automatic, servo-controlled, freely programmable, multipurpose manipulator, with several areas, for the handling of work pieces, tools, or special devices. Variably programmed operations make the execution of a multiplicity of tasks possible.”

  - **International Standards Organization (ISO)**

1.2 Types of Robot

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Based on level of sophistication

- Programmable robots
- Robots with environment understanding capabilities
- Robots with intelligence
- Robots with Artificial intelligence to produce its own clones

Types of Robot

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Based on Control

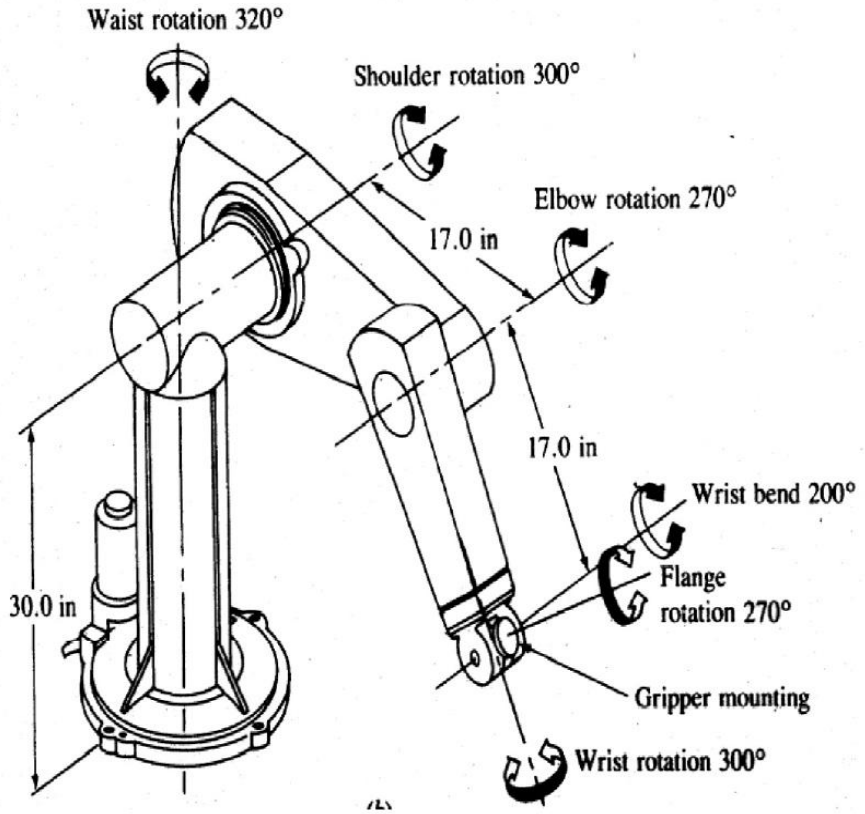
- Non servo
- Servo controlled
- Point To Point (PTP)
- Continuous Path (CP)

Robot Types Based on Manipulative Function

- Pick and place robots
- Special purpose robots
- Universal robots

1.3 major parts of a robot

- power supply
- control panel
- teach pendent
- manipulator
- servomotor


Waist rotation 320°
Shoulder rotation 300°
Elbow rotation 270°
17.0 in
17.0 in
Wrist bend 200°
Flange
rotation 270°
30.0 in
Gripper mounting
Wrist rotation 300°