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(AN AUTONOMOUS INSTITUTION)

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Department of Biomedical Engineering

Vision Tit 2 Vision Title 3

Course Name: ROBOTICS AND AUTOMATION IN MEDICINE

III Year : VI Semester

UNIT I : INTRODUCTION OF ROBOTICS

TITLE : Configurations and Concepts of Workspace

INTRODUCTION

OVERVIEW:

• Rapid evolution of robotics encompasses design, construction, and operation of robots for diverse tasks.

• Fundamental to this field is a profound understanding of robot configurations and workspace.

CONFIGURATIONS:

• Represent different poses or arrangements a robot can adopt.

• Crucial for effective programming and control of robots.

WORKSPACE:

• Defines the physical area where a robot can move and operate.

• Influences the range and scope of a robot's tasks.

DEFINITION OF WORKSPACE

WORKSPACE IN ROBOTICS:

- Refers to the physical region or area within which a robot can move, operate, and perform tasks.
- Essentially defines the boundaries and limitations of a robot's motion.

IMPORTANCE:

- Understanding the workspace is fundamental for effective robot design and operation.
- It influences the design of the robot's mechanical structure and the planning of its movements.

VISUALIZATION:

- Think of workspace as the three-dimensional envelope where the robot's end-effector or tool can reach.
- It is a key parameter in assessing a robot's capabilities and suitability for specific tasks.

CONFIGURATIONS IN ROBOTICS

DEFINITION:

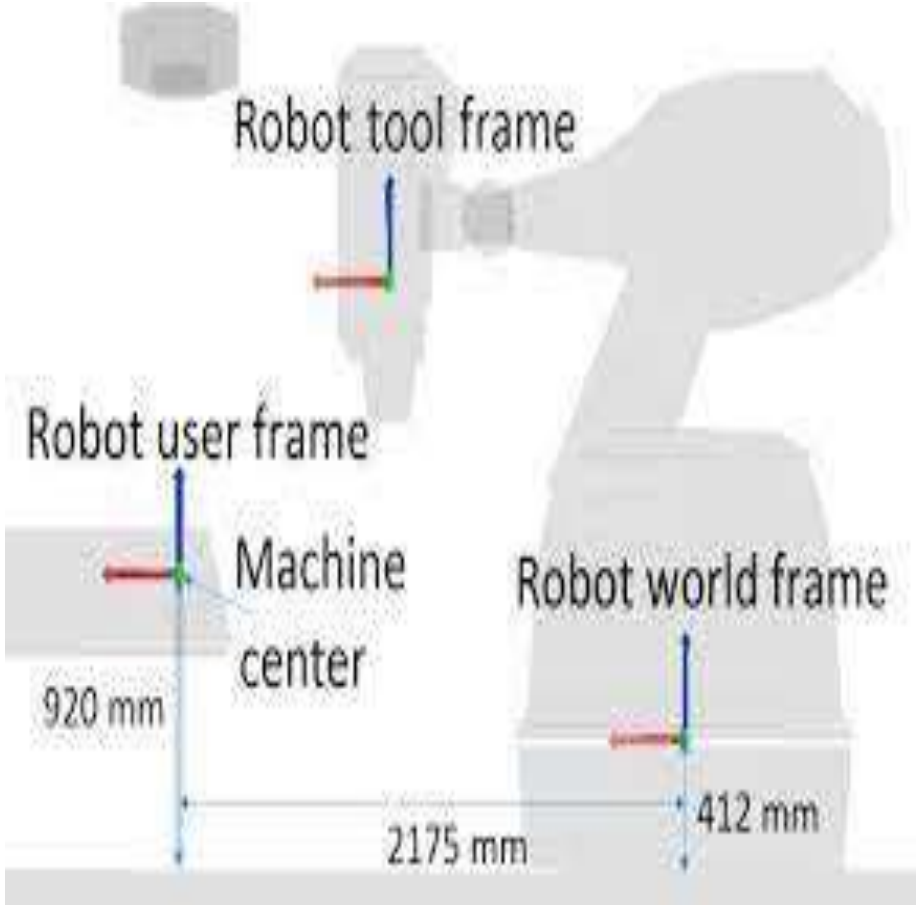
• Configurations refer to the different poses or positions a robot can take within its workspace.

• These poses are defined by the arrangement of the robot's joints and the orientation of its end-effector.

IMPORTANCE:

• Crucial for robot programming and control as it dictates how the robot moves and interacts with its environment.

• Different configurations enable the robot to adapt to various tasks and scenarios



TYPES OF CONFIGURATIONS

JOINT SPACE CONFIGURATION:

1.Describes the positions of individual joints.

2.Specifies the angles or displacements of each joint in the robot’s structure.

CARTESIAN SPACE CONFIGURATION:

1.Describes the robot’s position and orientation in a three-dimensional Cartesian coordinate system.

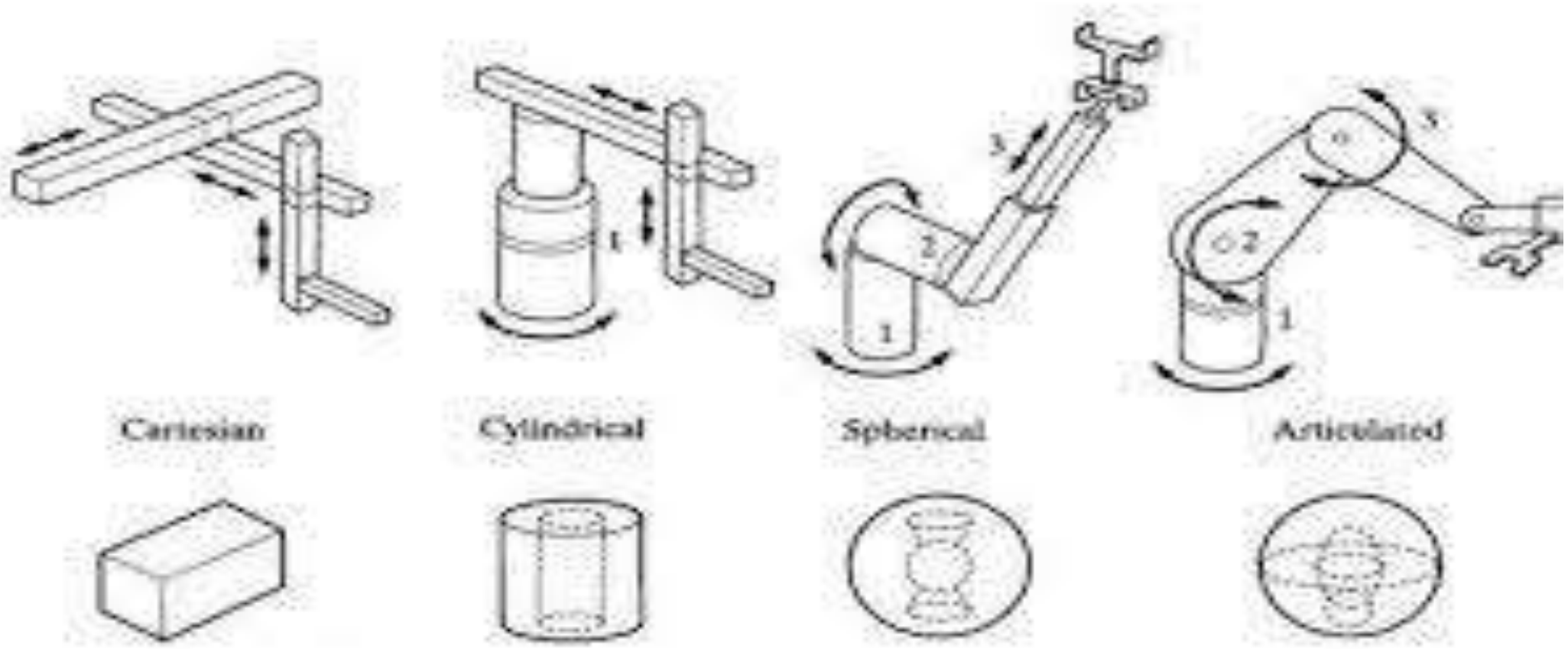
2.Provides a global perspective on the robot's location in space.

VISUAL REPRESENTATION:

Visualization of different configurations through diagrams and animations for better understanding.

APPLICATION:

Configurations play a critical role in tasks such as pick-and-place operations in manufacturing or precise movements in medical robotics.


Cartesian
Cylindrical
Spherical
Articulated

WORKSPACE ANALYSIS

IMPORTANCE OF WORKSPACE ANALYSIS:
Critical for evaluating a robot's capabilities and limitations.
Guides the design and implementation of effective robot tasks within a defined space.

FACTORS INFLUENCING WORKSPACE:
Joint limitations: Consideration of joint ranges and constraints.
Physical constraints: Including obstacles, boundaries, or workspace limitations.

VISUALIZATION OF WORKSPACE:
Graphic representation of a robot's workspace, demonstrating reachable points and areas.
Highlighting how joint limitations and physical constraints impact the overall workspace.

DYNAMIC WORKSPACE: Understanding how workspace changes dynamically as the robot moves and interacts.Emphasizing the adaptability of the robot to different operational scenarios.

REACHABILITY

Workspace Reachability:

In robotics, reachability refers to the ability of a robot's end-effector to reach a particular point or area within its workspace.

This depends on the robot's kinematic structure, joint limits, and potential obstacles. It's closely connected to the concept of workspace, as discussed earlier.

Configuration Reachability: This can refer to the ability to achieve a specific robot configuration (arrangement of its joints) from a starting position.

This involves calculating the joint angles necessary to reach the desired configuration and checking if those angles are within the robot's physical limitations.

APPLICATIONS

1. **Articulated Robots:** Show examples of complex assembly lines, intricate welds, and precise painting applications.
2. **Cartesian Robots:** Illustrate pick-and-place robots in action, machine loading/unloading automation, and precise positioning tasks
3. **SCARA Robots:** Showcase fast-paced assembly lines, automated packaging robots, and rapid pick-and-place applications.
4. **Delta Robots:** Show examples of high-speed food processing lines, hygienic food handling robots, and delicate packaging tasks.
5. **Polar Robots:** Illustrate large-scale welding robots, paint sprayers covering expansive surfaces, and efficient coating applications.
6. **Cylindrical Robots:** Showcase examples of robotic palletizers, machine loading/unloading for various industries, and material handling automation.


Thank you