# ROBOTICS AND AUTOMATION

*Dr. Ibrahim Al-Naimi*

# CHAPTER ONE

# Introduction To Robotics

# Outlines

- Definitions
- History
- Classifications
- Components
- Applications

# Definition

- *"A machine capable of carrying out a complex series of actions automatically"*. **Webster Dictionary**

- *"Any automatically operated machine that replaces human effort, though it may not resemble human beings in appearance or perform functions in a humanlike manner".* **Encyclopaedia**

# Definition

- *"A reprogrammable, multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks".* **Robot Institute of America**

- *"An electromechanical device with multiple degrees-of-freedom that is programmable to accomplish a variety of tasks".* **Ohio University**

- *" A goal oriented machine that can sense, plan, and act".* **Peter Corke**

# History

- **1920** - The word 'Robot' appeared in a Czechoslovakian play.

- **1941** - Isaac Asimov introduced the word 'Robotics' in the science fiction short story "Liar".

- **1954** - First industrial/programmable Robot (Unimate) used in manufacturing T.V. tubes

- **1962** - First Robot Company (Unimation) and First installed industrial robot.

# History

- **1968** - Mobile Robot with Vision (Shaky) developed at Stanford Research Institute
- **1978** - Programmable Universal Machine for Assembly (PUMA) developed at General Motors.
- **1979** - SCARA (Selective Compliant Articulated Robot for Assembly) introduced in Japan (by Adept Technologies).
- **2000** - Honda debuts humanoid robot (ASIMO)
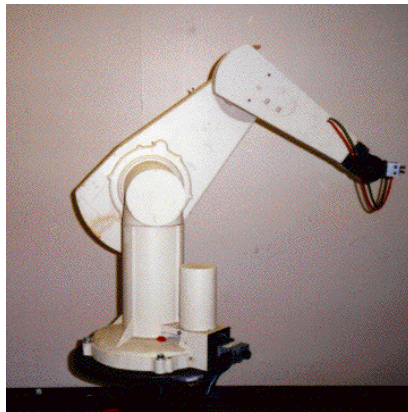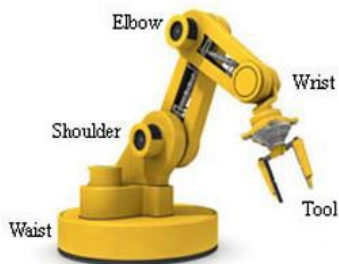


Shaky          PUMA          SCARA

# Classifications

- **Fixed robots (Manipulators)**
- **Mobile robots (Locomotion)**
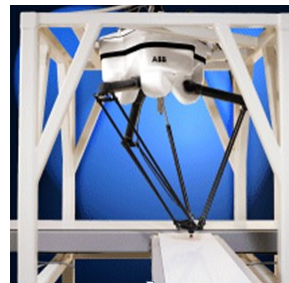- **Hybrid.**

# Classifications

- **Fixed robots (Manipulators)**

  Several links are connected through various joints. The base is attached to the ground/fixed.



Serial



Parallel

# Classifications

- **Mobile robots (Locomotion)**

  Mobile robots can move, interact, and perform several tasks in different environments.



Ground                    AUV                    UAV

# Classifications

- **Hybrid robots/Humanoid**

  Mobile robot which is provided by an arm

# Components

- **Mechanical structure:** Body, frames, gears, belts, etc.
- **Sensors:** Vision, force, proximity, etc.
- **Actuators:** Electric (DC, stepper, AC), hydraulic, etc.
- **Power:** Battery, AC/DC, or Solar.
- **Electronics :** Conditioning and power circuits.
- **Controller:** Process sensory information and provides appropriate commands
- **Software and user interface**

# Applications

- Industry
- Military
- Space Exploration
- Transportation
- Healthcare
- Entertainment
- Household
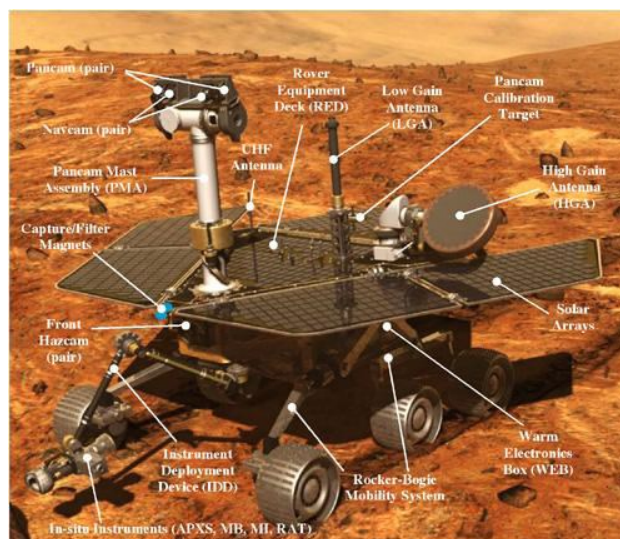
# Applications: Industry (Automobile)
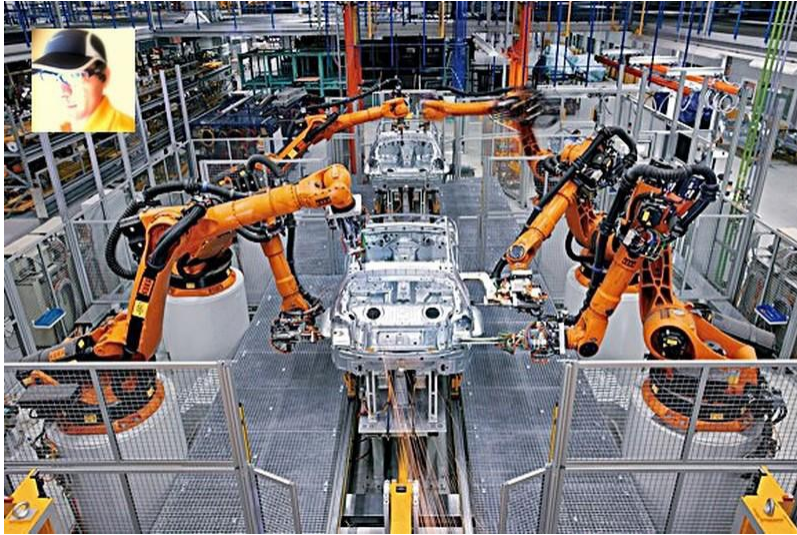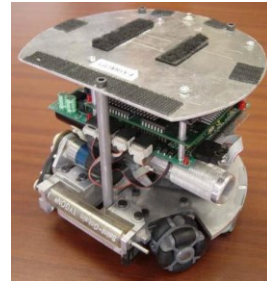


# Applications: Industry (Pick and Place)

# Applications: Military



# Applications: Space Exploration

# Applications: Entertainment



# Applications: Healthcare