

Chapter 1

Introduction and Basics

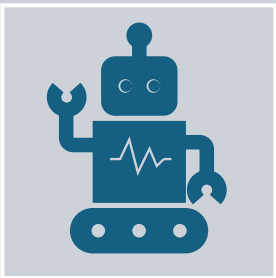


Robot Definition

- Word robot was coined by a Czech novelist Karel in a 1920 play titled Rassum's Universal Robots (RUR)
- Robot in Czech is a word for worker or servant



Karel Capek

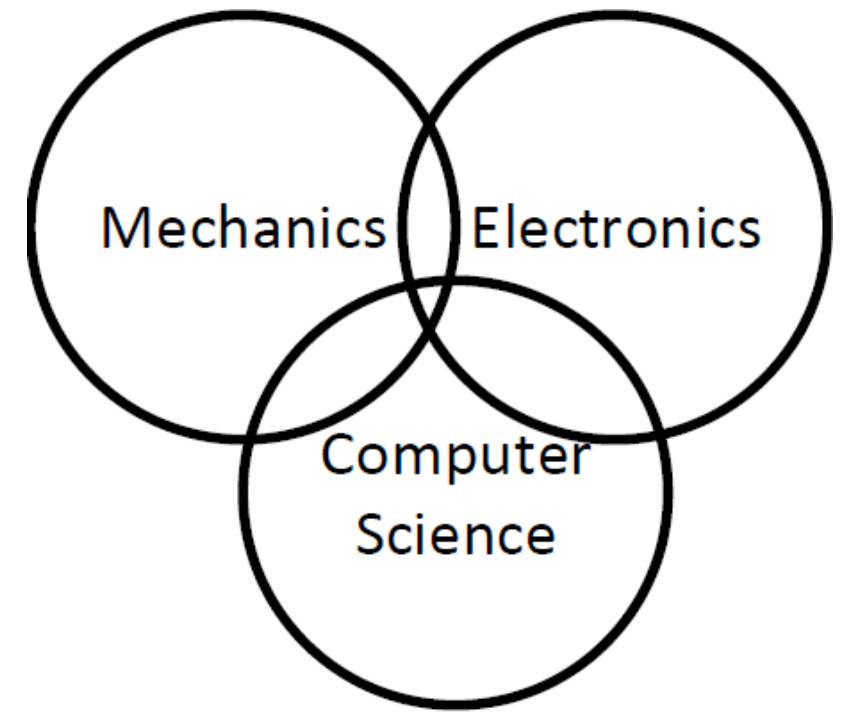


Definition of robot
(Robot Institute of
America (RIA):

A robot is 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

Robots in general:

- is a complex machine composed by:
 - A mechanical system for interacting with the environment.
 - An actuation system for task execution.
 - A sensory system for getting proper information.
 - A control system for the run-time control and programming.



Multi-disciplinary “science”

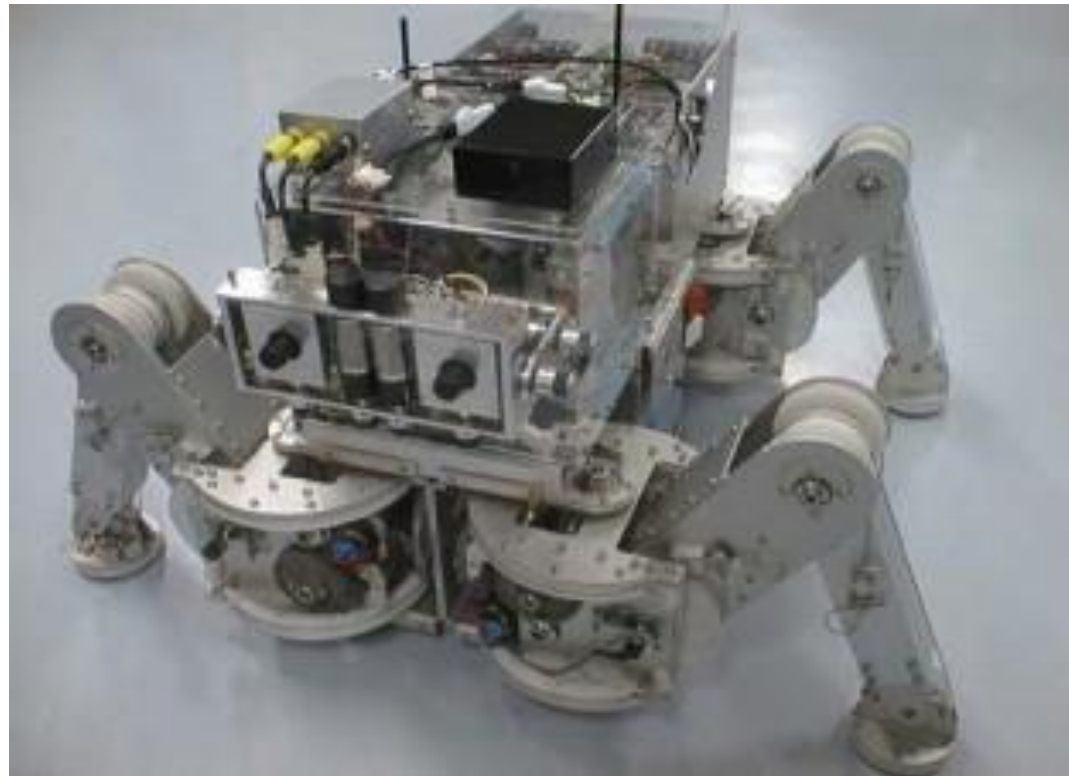
Types of Robots: I

Manipulator

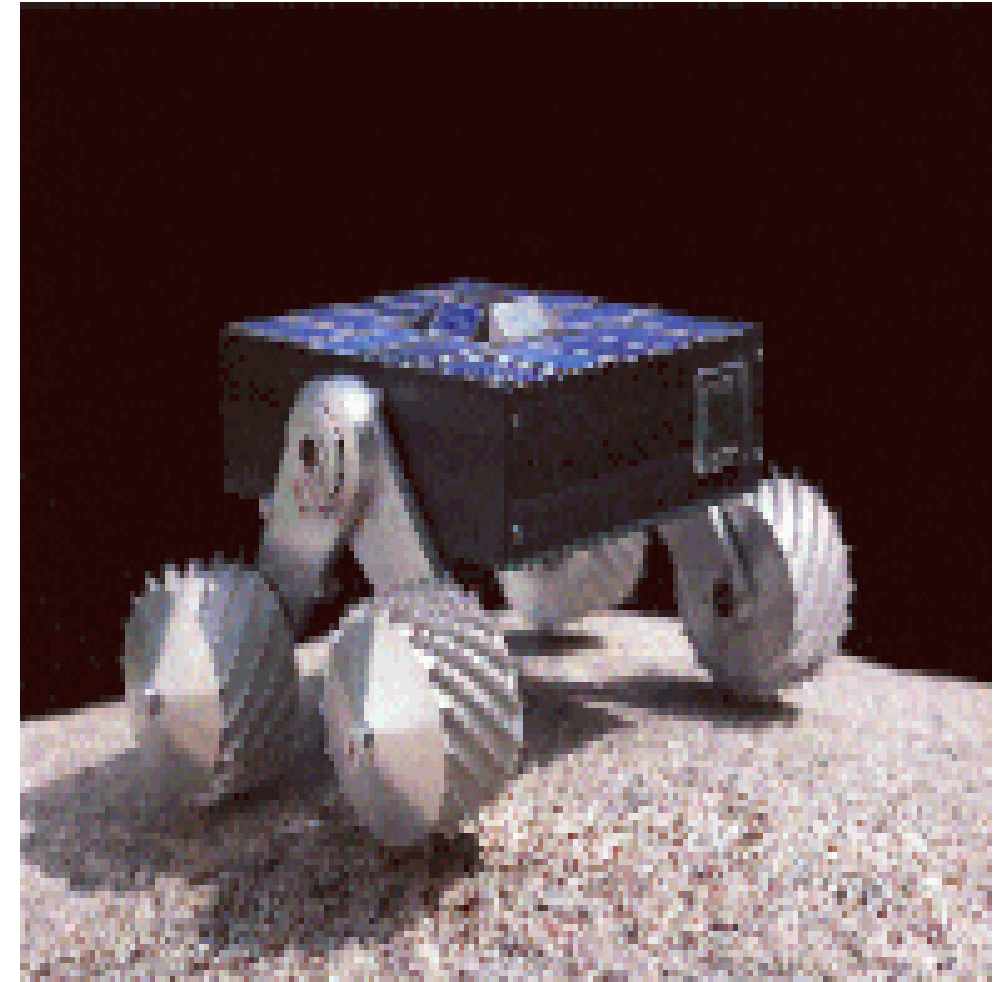


Types of Robots: II

Legged Robot



Wheeled Robot



Types of Robots: III

Autonomous Underwater Vehicle



Unmanned Aerial Vehicle



Jobs that are dangerous for humans

Robot Uses: I

Decontaminating Robot

Cleaning the main circulating pump housing in the nuclear power plant



Robot Uses: II

Repetitive jobs that are boring, stressful, or labor-intensive for humans



Robot Uses: III

Menial tasks that human
don't want to do

The SCRUBMATE Robot



Robots in Industry

Agriculture

Automobile

Construction

Entertainment

Health care:
hospitals, patient-
care, surgery,
research, etc.

Laboratories:
science,
engineering , etc.

Law enforcement:
surveillance,
patrol, etc.

Manufacturing

Military: demining,
surveillance,
attack, etc.

Mining,
excavation, and
exploration

Transportation:
air, ground, rail,
space, etc.

Utilities: gas,
water, and electric

Warehouses

Industrial Applications of Robots



Material handling



Material transfer



Machine loading
and/or unloading



Material Handling
Manipulator



Assembly Manipulator

Robots in Space

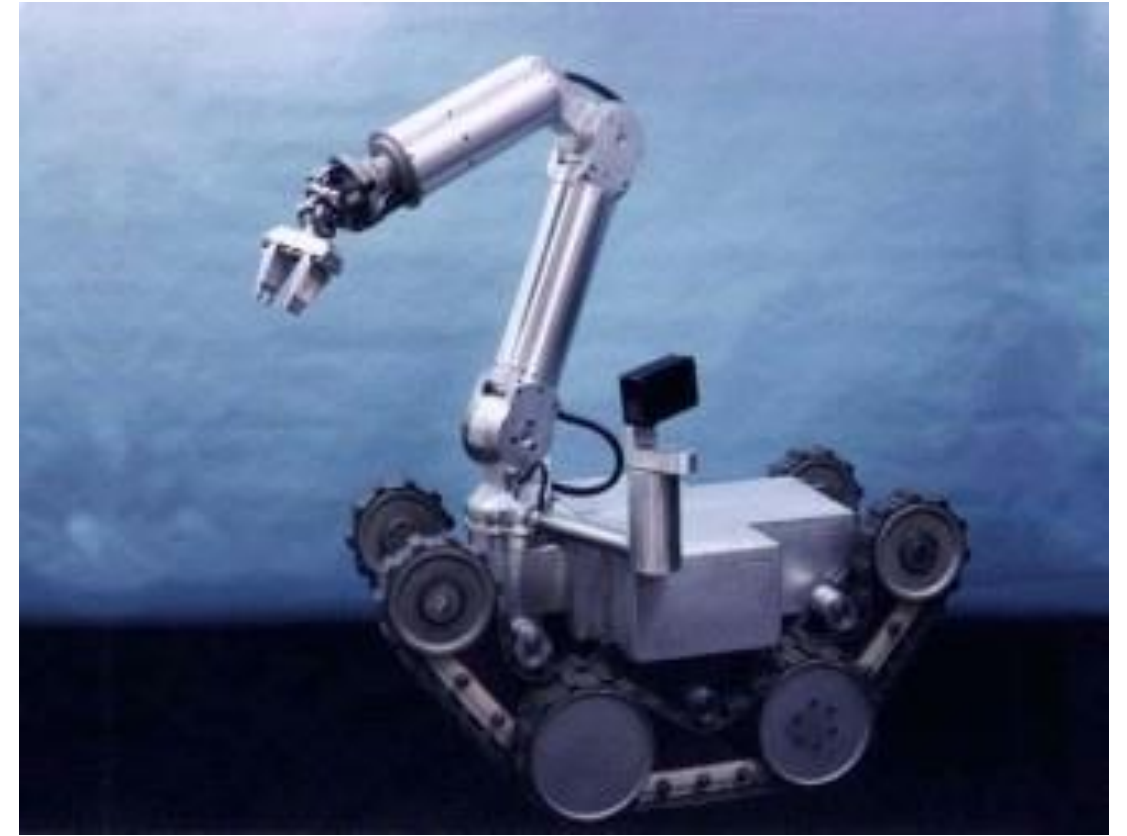


NASA Space Station

Robots in Hazardous Environments



TROV in Antarctica operating under water



HAZBOT operating in atmospheres containing combustible gases

Medical Robots



Robotic assistant for
micro-surgery



Davinci Surgical Robot



Robear Nursing Robot

Service Robots



Agrobot Strawberry Harvesters



AIST Construction Robot

Robots in Military



SPLIT STRIKE:

Deployed from a sub's hull, Manta could dispatch tiny mine-seeking AUVs or engage in more explosive combat.



PREDATOR



ISTAR



GLOBAL HAWK



GOLDENEYE

Robots at Home



Sony SDR-3X Entertainment Robot



Sony Aibo

Humanoids

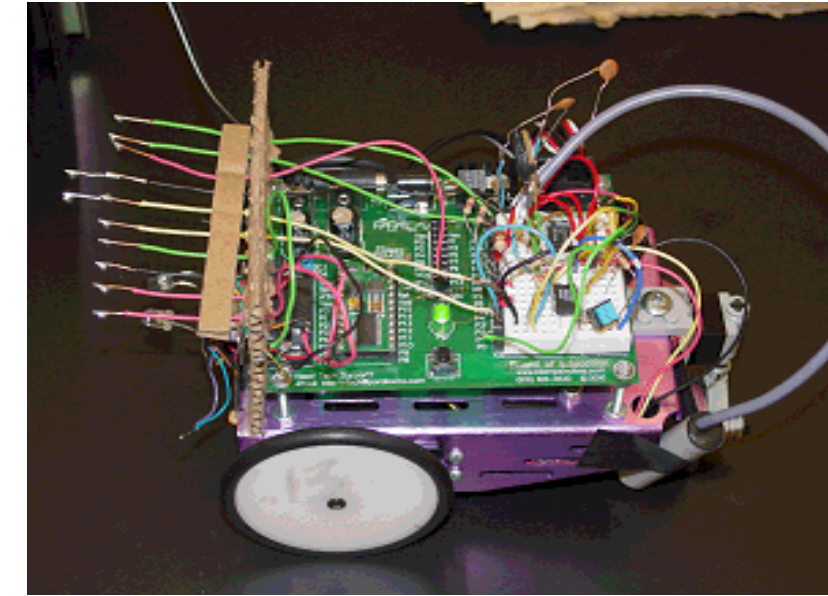
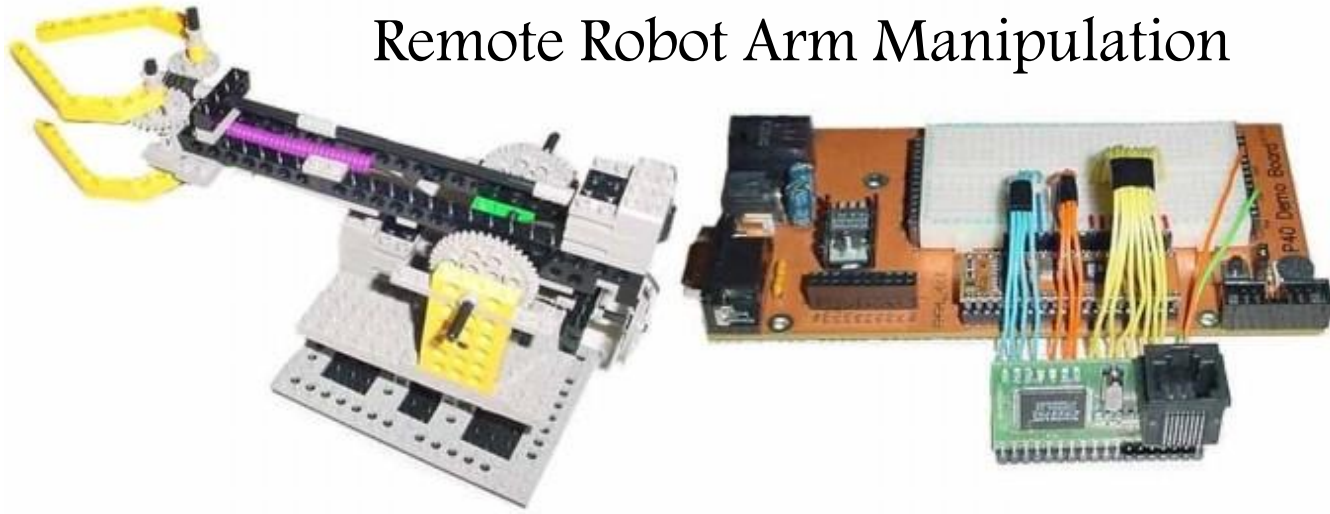


HONDA Humanoid Robot



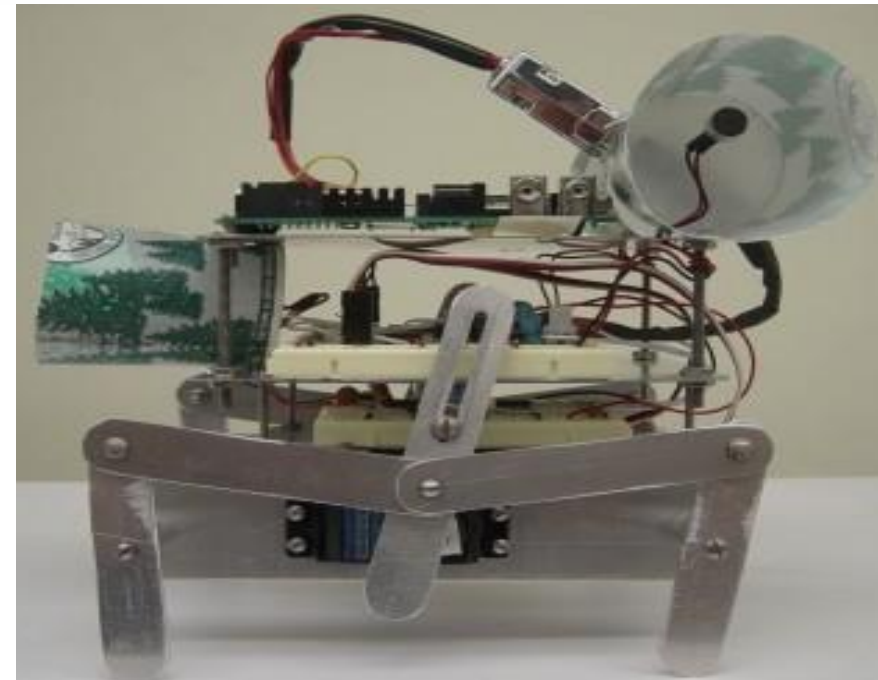
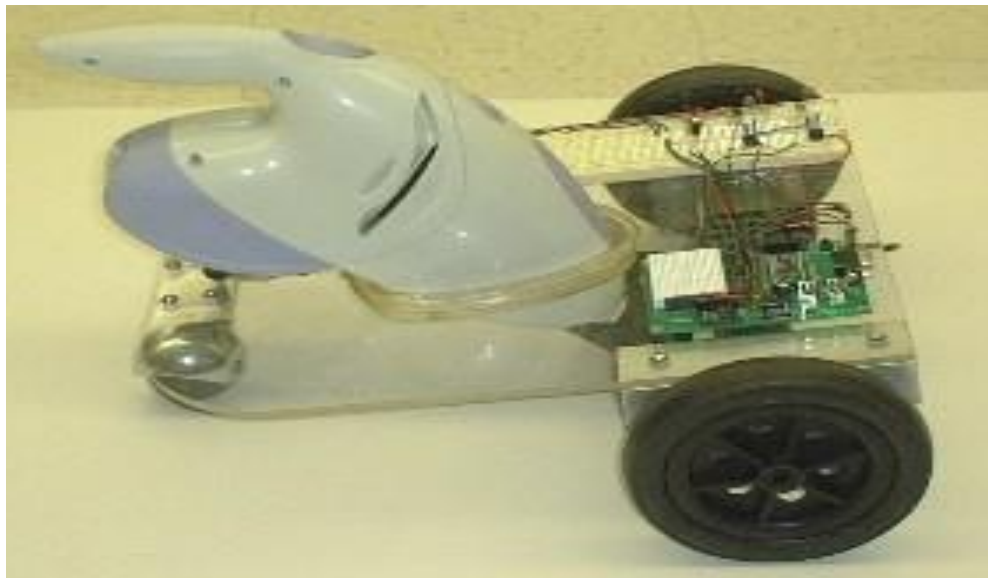
Robotics Projects

Remote Robot Arm Manipulation



Smart Irrigation System

Robotic Vacuum Cleaner



Hexapod for disaster recovery

Robotics @ Effat University

Laws of Robotics

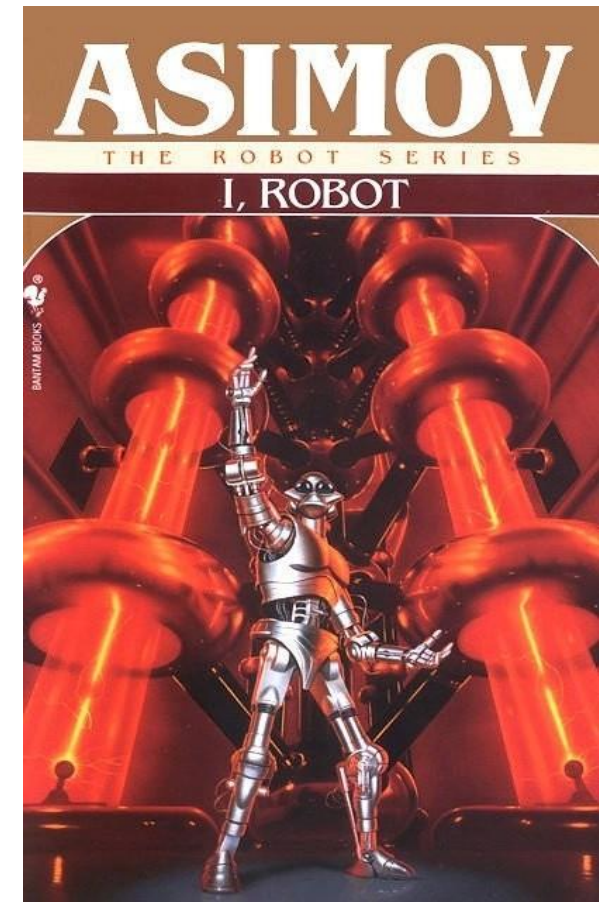
A robot may not injure humanity, or, by inaction, allow humanity to come to harm.



A robot must obey orders given to it by human beings, except where such orders would conflict with a first law



A robot must protect its own existence as long as such protection does not conflict with the first or second laws



History of Robotics: I

The first industrial robot: UNIMATE.

- 1954: The first programmable robot is designed by Goerge Devol, who coins the term **Universal Automation**.
- He later shortens this to **Unimation**, which becomes the name of the first robot company (1962).

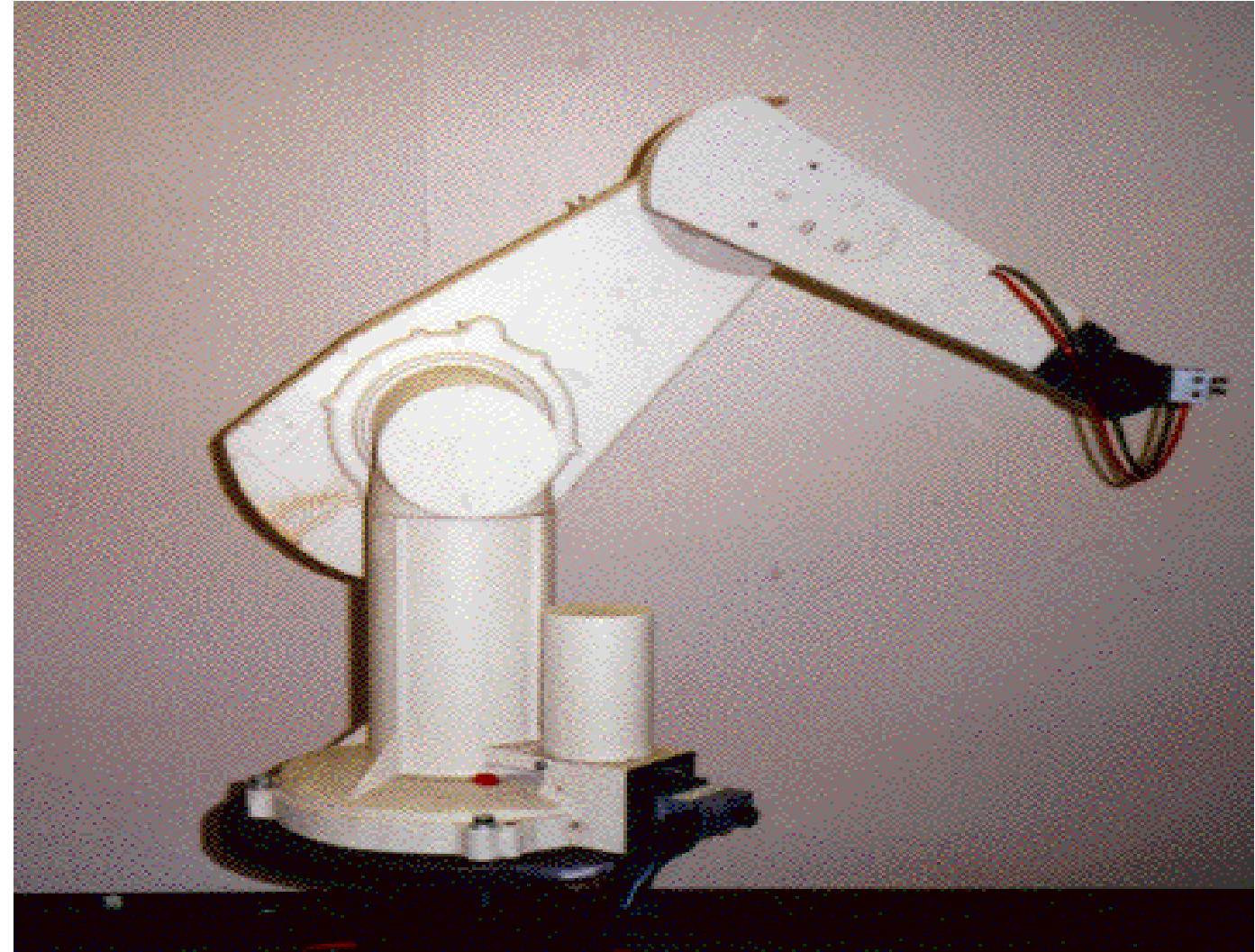


UNIMATE originally automated the manufacture of TV picture tubes

History of Robotics: II

1978:

Puma (Programmable Universal Machine for Assembly) robot is developed by Unimation with a General Motors design support



PUMA 560 Manipulator

History of Robotics: III

1980s:

- The robot industry enters a phase of rapid growth.
- Many institutions introduce programs and courses in robotics:
- mechanical engineering,
- electrical engineering,
- computer science departments.

History of Robotics: IV

1995–Present:

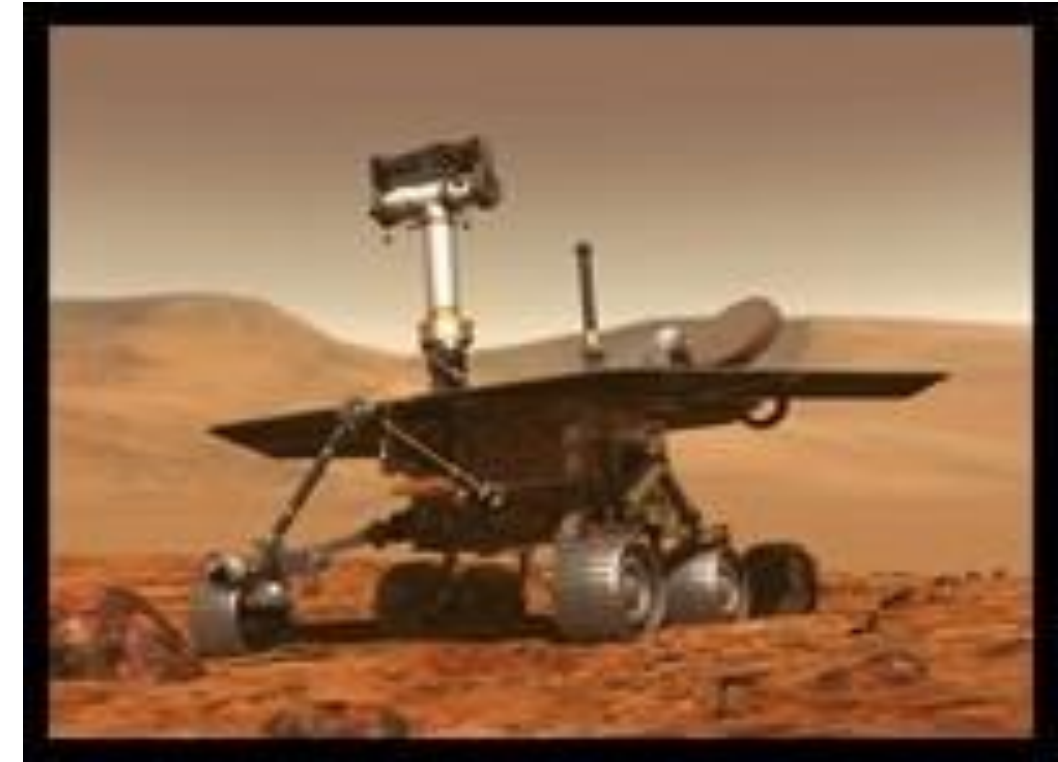
Emerging applications in small robotics and mobile robots drive a second growth of start-up companies and research.



Adept's SCARA robots



Cognex In-Sight Robot



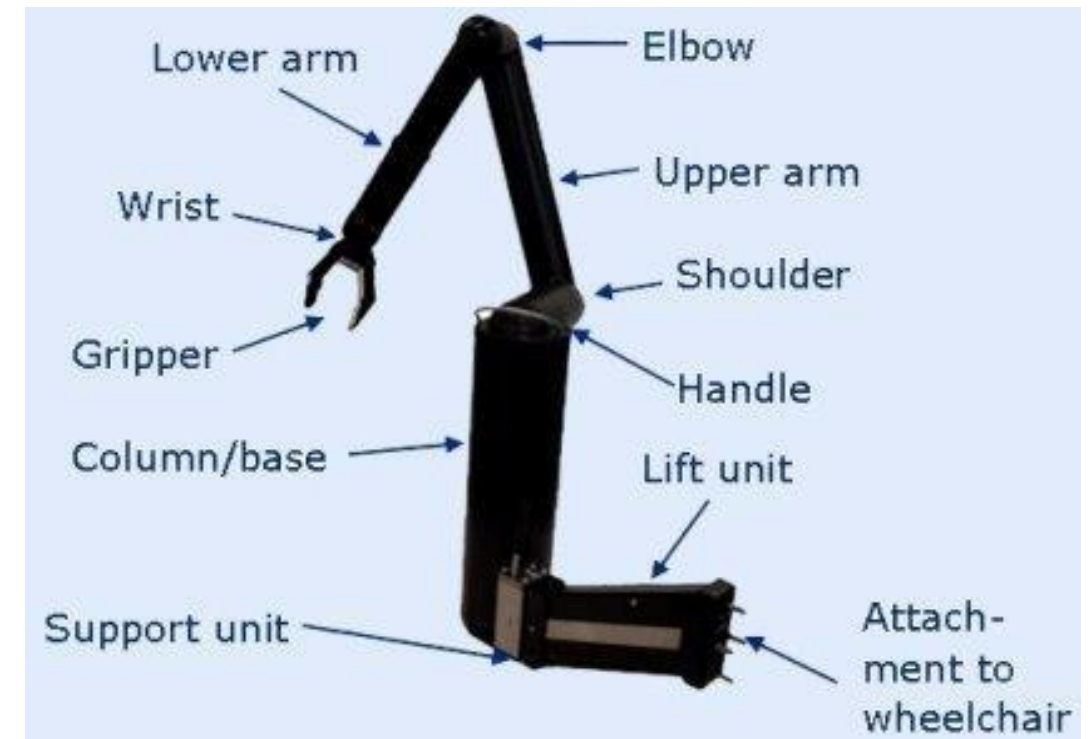
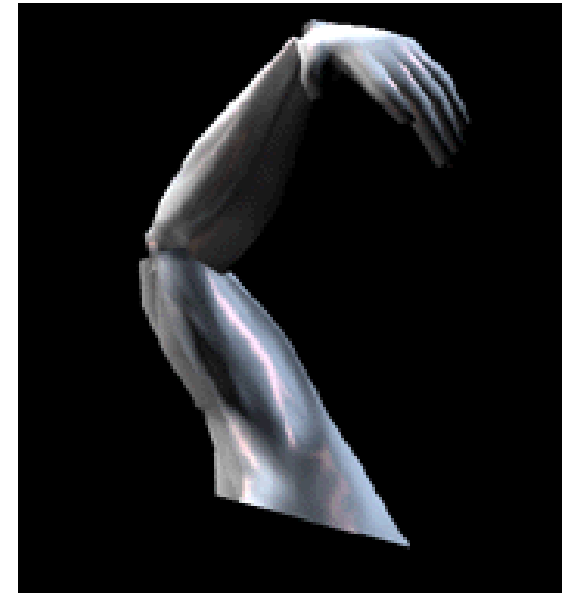
2003: NASA's Mars Exploration Rovers launch toward Mars in search of answers about the history of water on Mars

Barrett Technology Manipulator

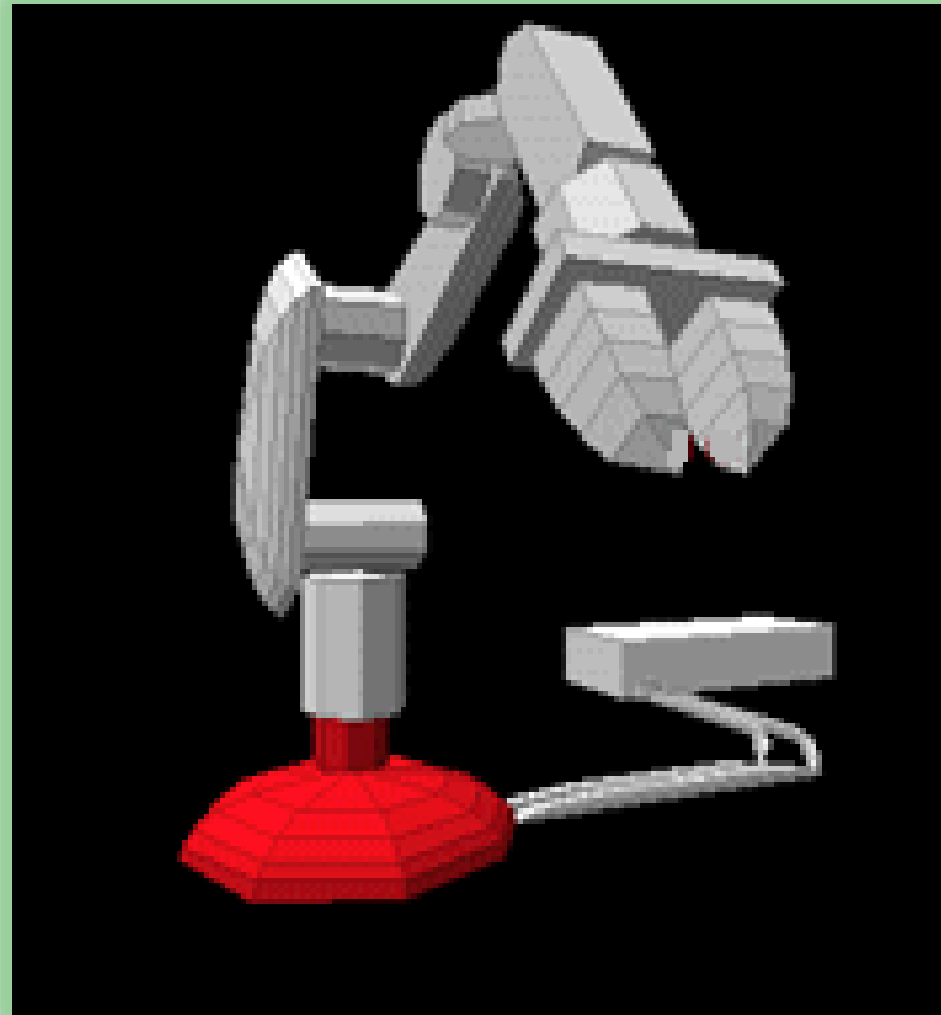


Manipulator (Mimics the human arm)

- Constructed using rigid links connected by joints
- Joints are the movable components, which enable relative motion between the adjoining links
- Each has a degree of freedom



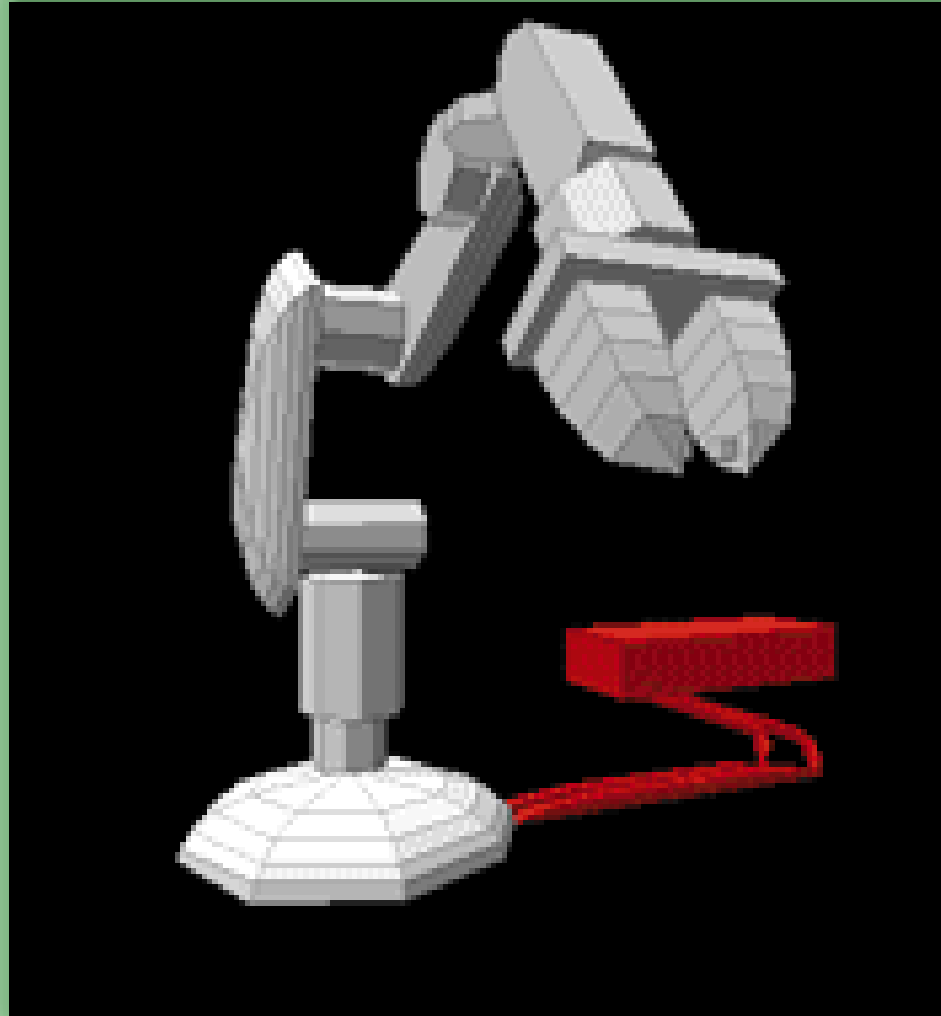
Pedestal



(Human waist)

- **Supports the manipulator.**
- **Acts as a counterbalance.**

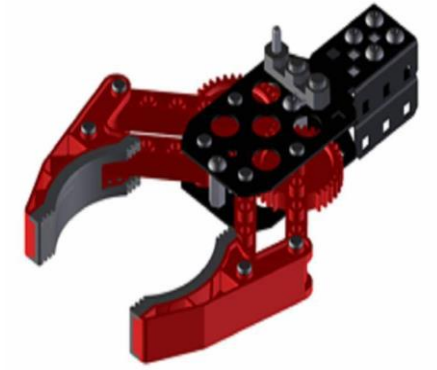
Controller



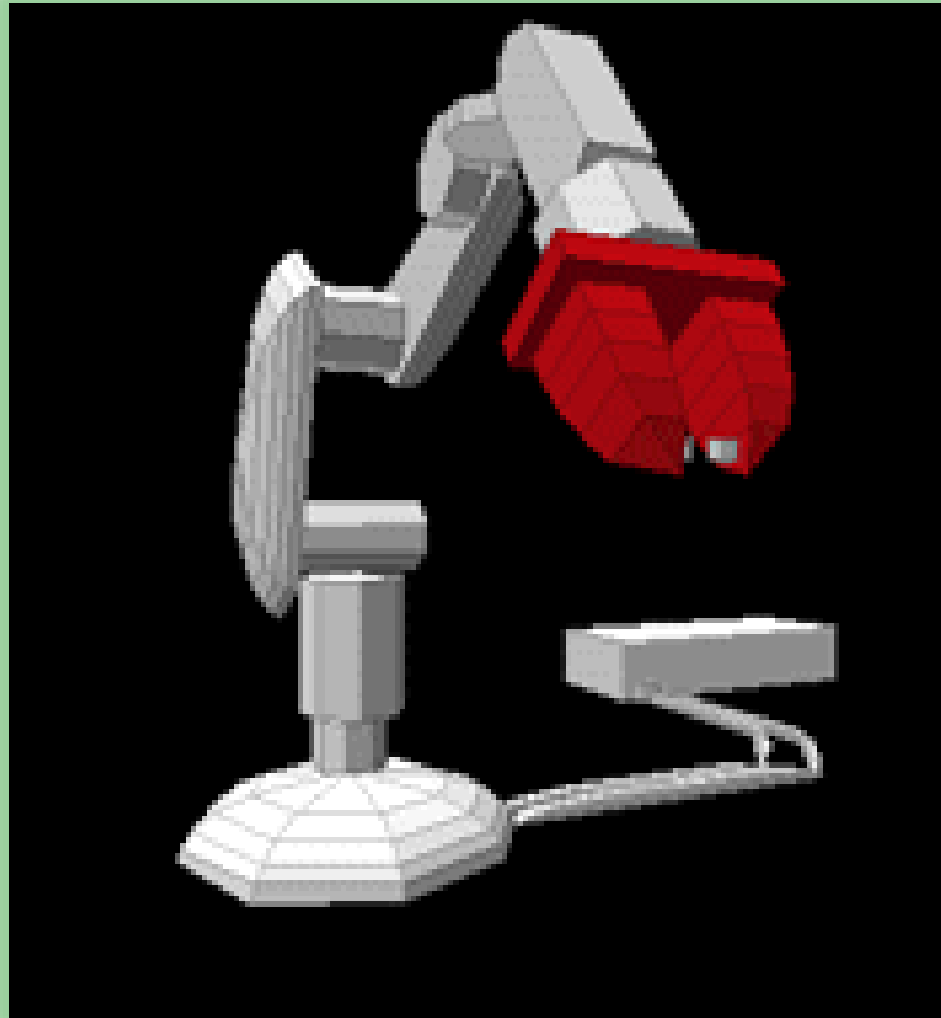
(The brain)

- **Issues instructions to the robot.**
- **Controls peripheral devices.**
- **Interfaces with robot.**
- **Interfaces with humans.**

End Effectors



(The hand)



- **Spray paint attachments**
- **Welding attachments**
- **Vacuum heads**
- **Hands**
- **Grippers**

Power Source



(The food)

- **Electric**
- **Pneumatic**
- **Hydraulic**