



ROBOTICS 1

LESSON 01

Robotic Automation & Basic Terminologies

IMRAN KHAN

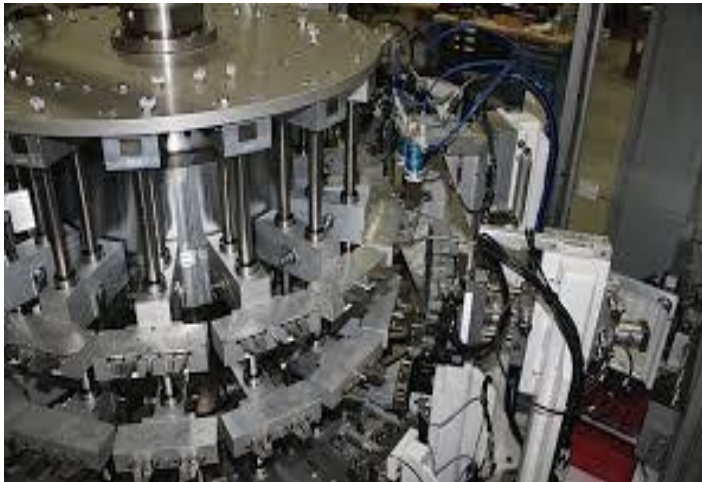
School of Applied Technology
Robotics and Automation

FACTORY AUTOMATION



Automation

- Hard Automation



Hard Automation



Flexible Automation

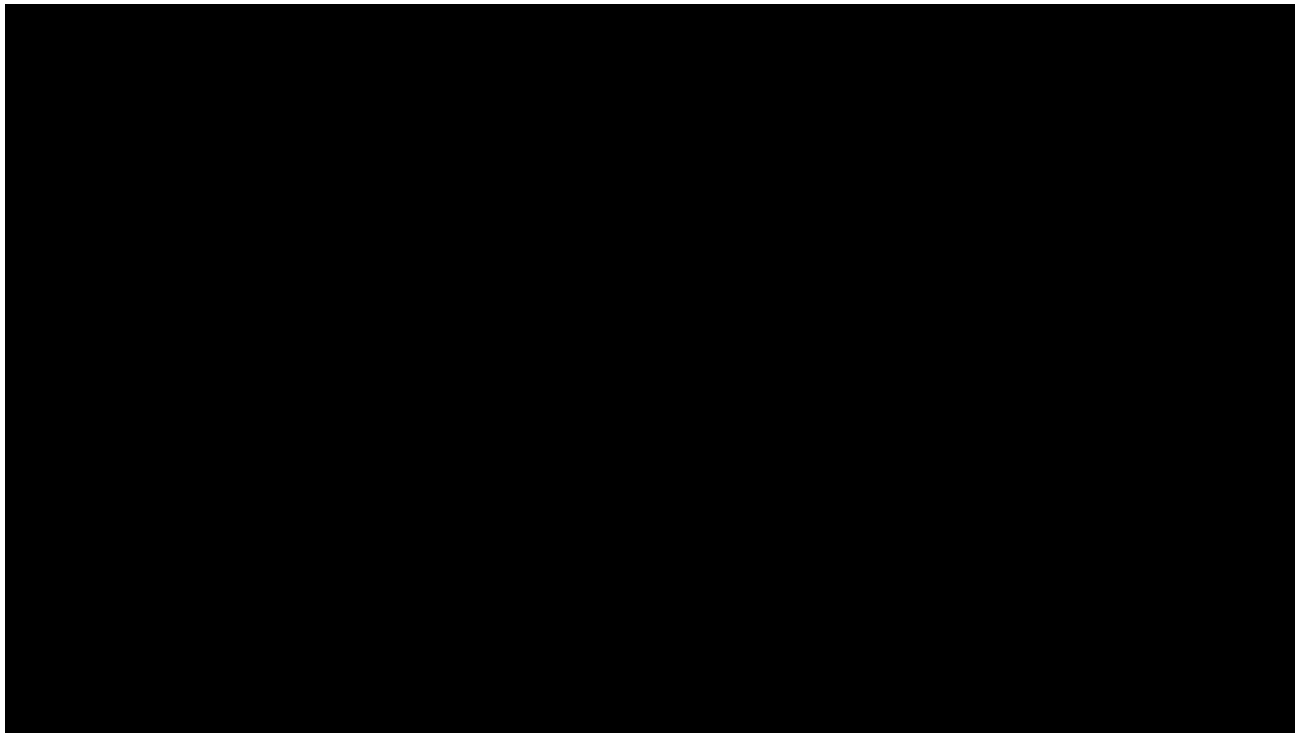
Hard Automation

- Specific task machines
- Highly precise and reliable
- Work for large production
- Retooling is costly

Flexible Automation

- Flexible machines (Robots)
- Reprogrammable
- Easy and affordable re-tooling

Hard and Flexible Automation



Brief History

- The word robot was introduced in 1921.
- Word *robota*, meaning (forced) work“
- First movie involving robots: “**Metropolis**,”
1926

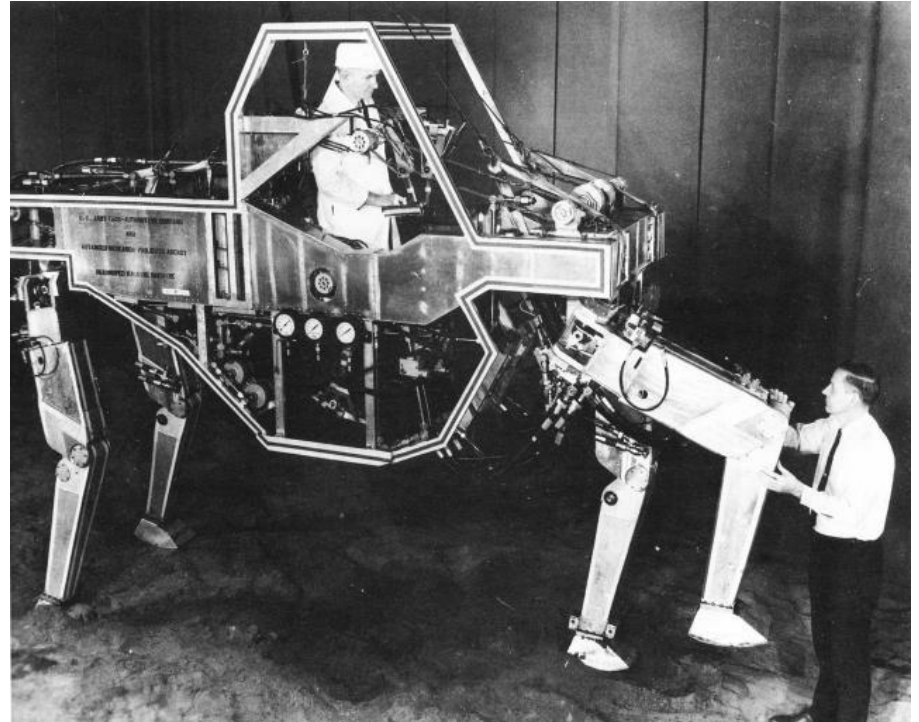
Brief History

- 1952: First Numerically Controlled
- The first modern industrial robots: “Unimates”
- 1962: GM Installed its first Unimation



First Walking Robot

Walking Truck large (3,000pounds) four legged robot that could walk up to four miles per hour. The walking truck was the first legged vehicle with a computer-brain, developed by Ralph Moser at General Electric Corp in 1960.



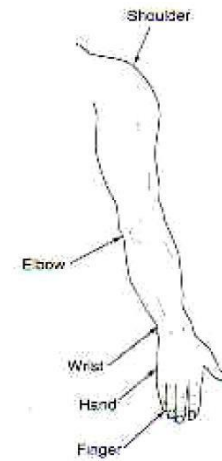
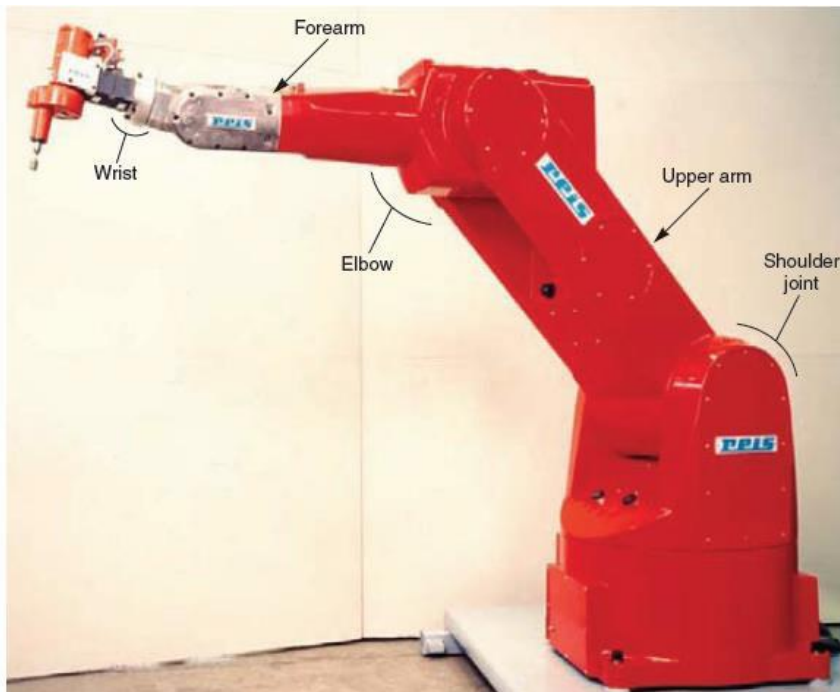
Robotics Norms

- A robot may not injure a human being, or through inaction allow a human being to come to harm.
- A robot must obey the orders given it by human beings, except where such orders would conflict with the first law.
- A robot must protect its own existence as long as such protection does not conflict with the first or second law.

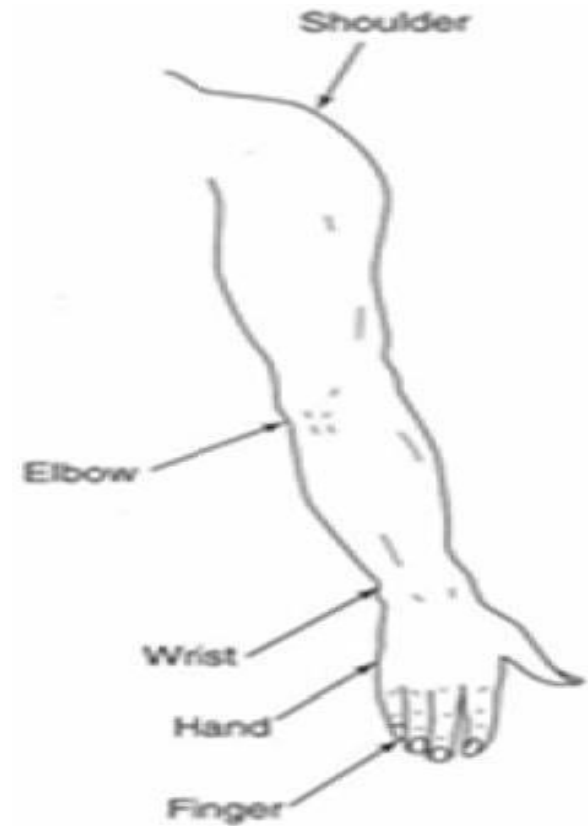
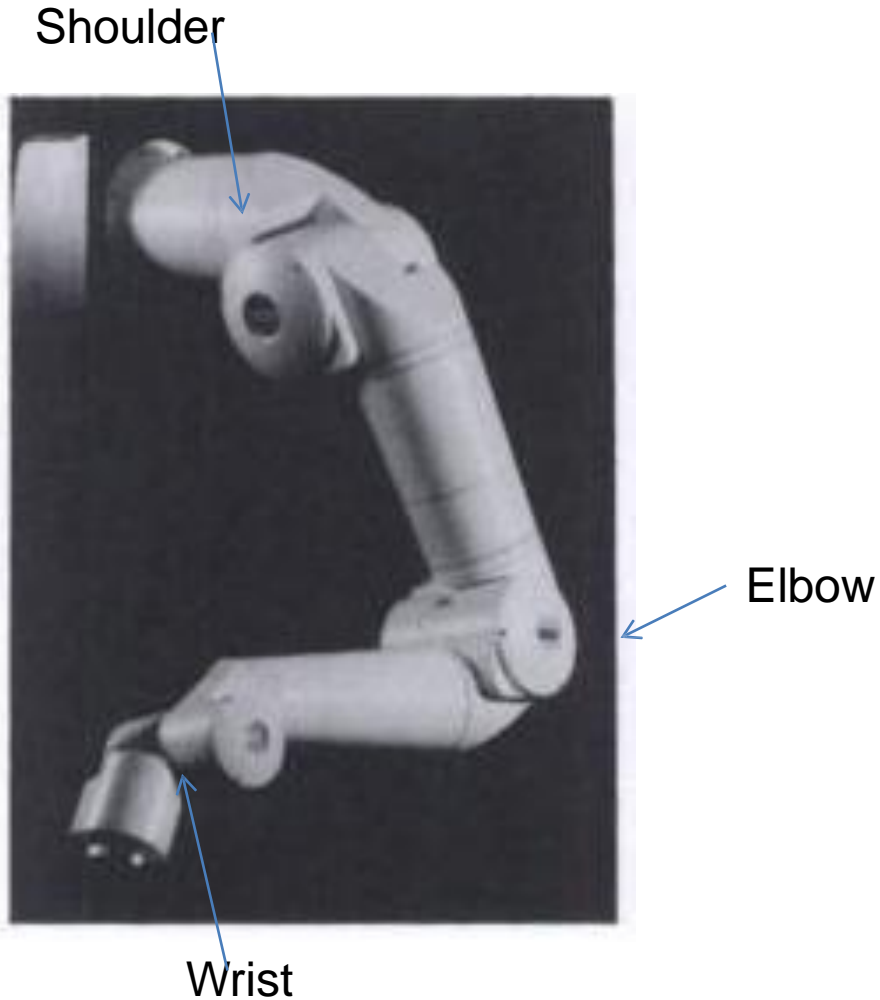
Robot Definitions

-
- Any device which replaces human labor (*Sosoka, Japan, 1985*)
- A programmable multifunction manipulator designed to move material, parts, or specialized devices through variable programmed motions for performance of a variety of tasks (*Robotics Institute of America, Schlusser, 1985*).
- A robot is a machine which can be programmed to do a variety of tasks, in the same way that a computer is an electronic circuit which can be programmed to do a variety of tasks (*McKerrow, 1986*).
- Robotics is the intelligent connection of perception to action (*Mike Brady, Oxford, 1985*).

Robotics Manipulator Vs Human Manipulator



ROBOTIC ARM SIMULATE TO HUMAN ARM



Robotic Arm Vs Human Arm

Human Arm

- Key Elements
 - Bone and tissue Joints
 - Bones
 - Muscles
 - Skin
 - Controller (Brain)

Robotic Arm

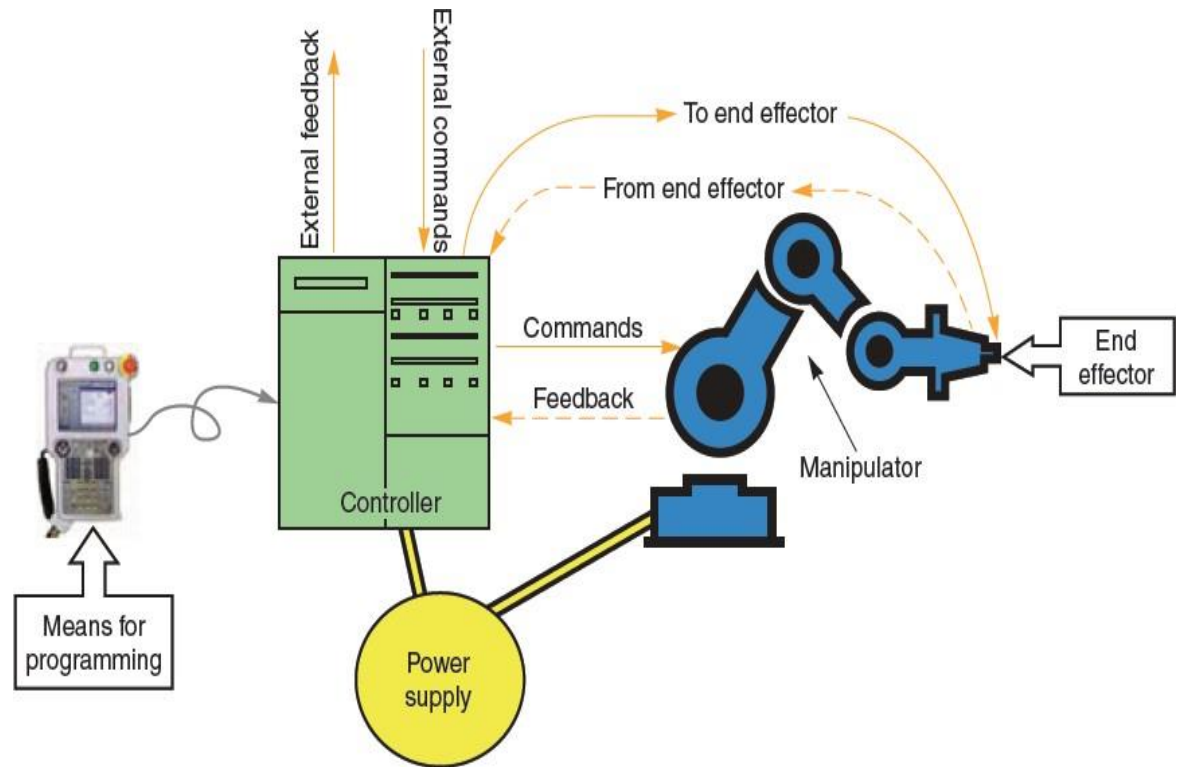
- Key Elements
 - Mechanical Joints
 - Links
 - Motor / Actuator
 - Sensors (Tactile sensors)
 - Controller (Computer / Processor)

Robotic Arm



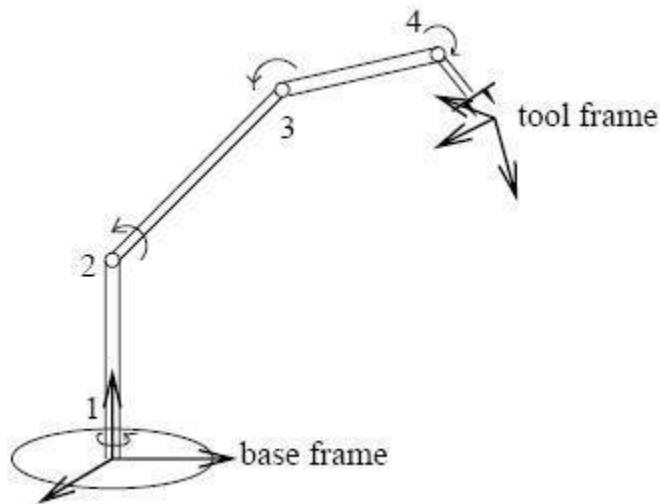
Parts of a Robot

- Manipulator
- End Effectors
- Controller
- Power Supply
- Programming



Robotic Arm / Robotic Manipulator

- A manipulator is defined by set of links connected through hinges or joints that allows relative motion between two consecutive links



SOME MAJOR ROBOT MANUFACTURERS



YASKAWA
MOTOMAN ROBOTICS



FANUC



KUKA



ABB



Kawasaki



NACHI



COMAU
ROBOTICS



Panasonic



adept



DENSO
robotics

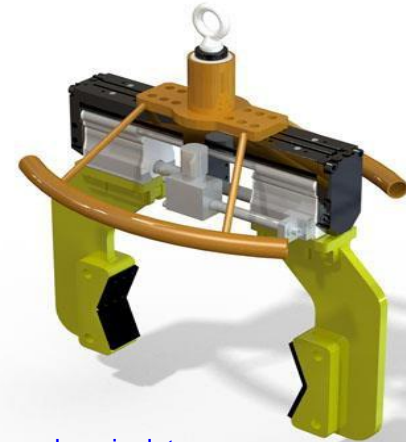
Controller

The *controller* is the part of a robot that coordinates all movements of the mechanical system. It also receives input from the immediate environment through various sensors. The heart of the robot's controller is generally a microprocessor linked to input/output and monitoring devices.

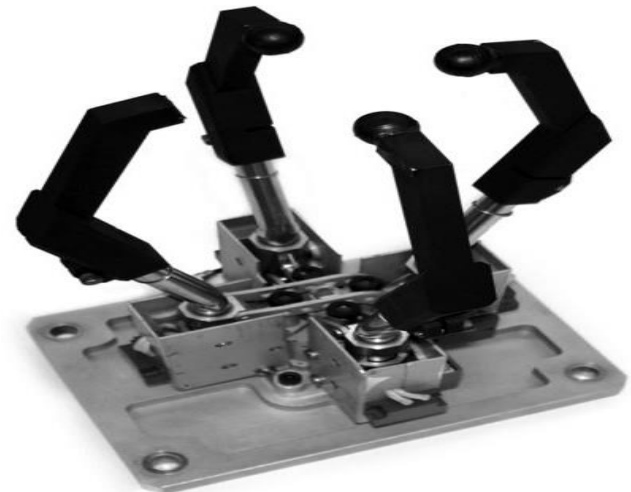


End-Effector

The last link of the robotic arm that interact with the environment through the tool is called an end-effector.



Source: www.advancedmanipulator.com



Source: wikipedia.org/wiki/File:Endeffector.png

Power Supply

The *power supply* provides the energy to drive the controller and actuators.

It may convert ac voltage to the dc voltage required by the robot's internal circuits, or it may be a pump or compressor providing hydraulic or pneumatic power. The three basic types of power supplies are electrical, hydraulic, and pneumatic.



Means of Programming

The means for programming is used to record movements into the robot's memory. A robot may be programmed using any of several different methods. The *teach pendant* teaches a robot the movements required to perform a useful task.



Classification of Robots

Manual Manipulator

Manipulator worked by human operator

Fixed-sequence robot

Manipulator performs predetermined steps

Instructions not easily changed

Variable sequence robot

Manipulator performs predetermined steps

Instructions easily changed

Classification of Robots

Playback robot

Manipulator reproduces operations based on operator instructions
Instructions stored in memory

Numerically controlled (NC) robot

Manipulator performs task based on numerical data

Intelligent Robot

A robot that can detect the environment and can make the decision

Generation of Industrial Robots

First Generation

- Information robots
- Robots for Education
- Injection molding robots
- Painting robots

Second Generation

- Cleaning robots
- Security robots
- Intelligent robot
- Assembly robot

3rd Generation

- Personal robots
- Medical robots
- Cellular robots
- Navigation robots
- Space robots
- Micro-robots

Robotic Applications

- Industrial
- Medical Science
- Space Exploration
- Remote Area

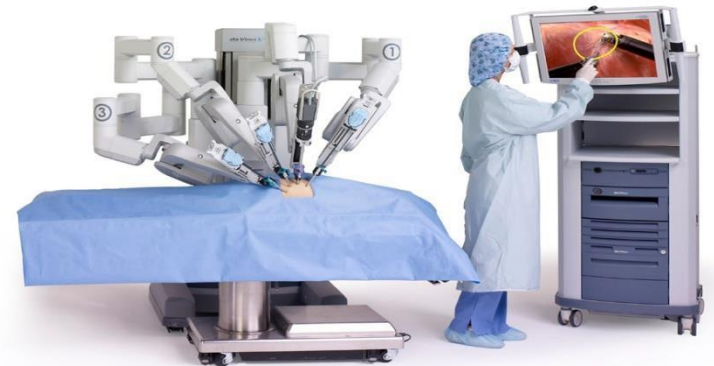
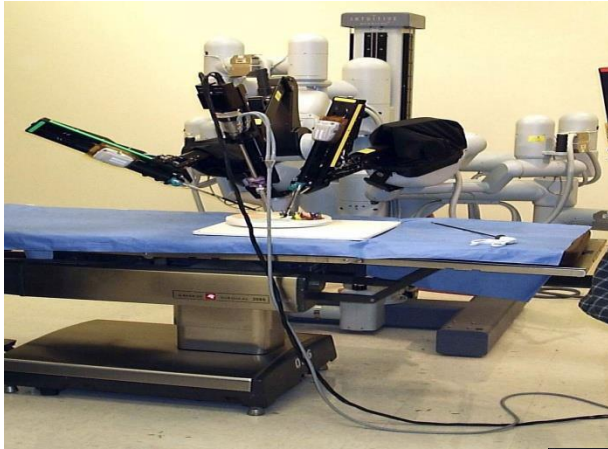
Industrial Application

- Arc & Spot Welding
- Spray Painting
- Assembly
- Material Handling
- Packaging
- Simple repetitive tasks
- Adaptability & reprogrammable operation



[source: www.magoda.com](http://www.magoda.com)

Medical Application

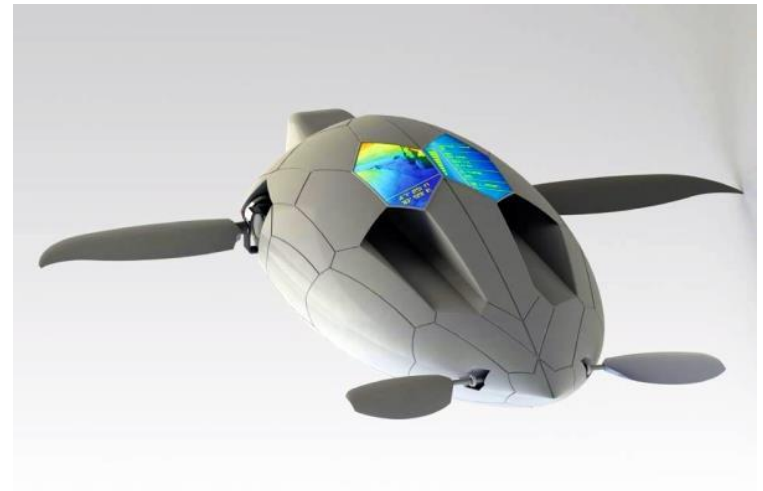


Robot Assist in Surgery (Wikipedia)

Space and Under Water Application



ASIMO Humanoid Robot (Japan)



Turtle Sea Robot