

Humanoid robotics



Robot Base

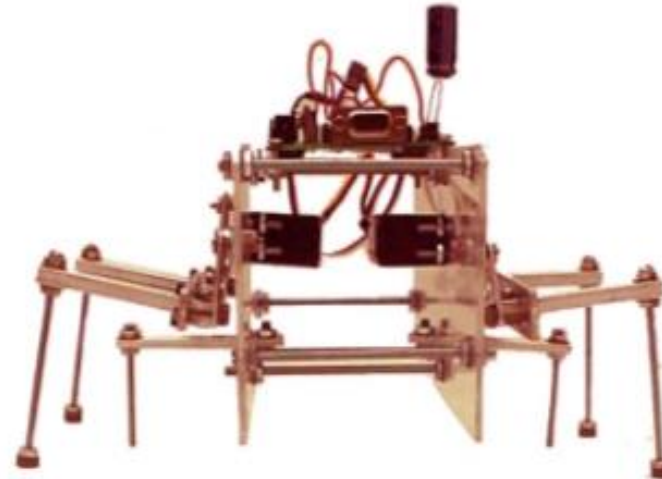
Fixed v/s Mobile

Robotic manipulators used in manufacturing are examples of fixed robots. They can not move their base away from the work being done.



4255 robot

Mobile bases are typically platforms with wheels or tracks attached. Instead of wheels or tracks, some robots employ legs in order to move about.

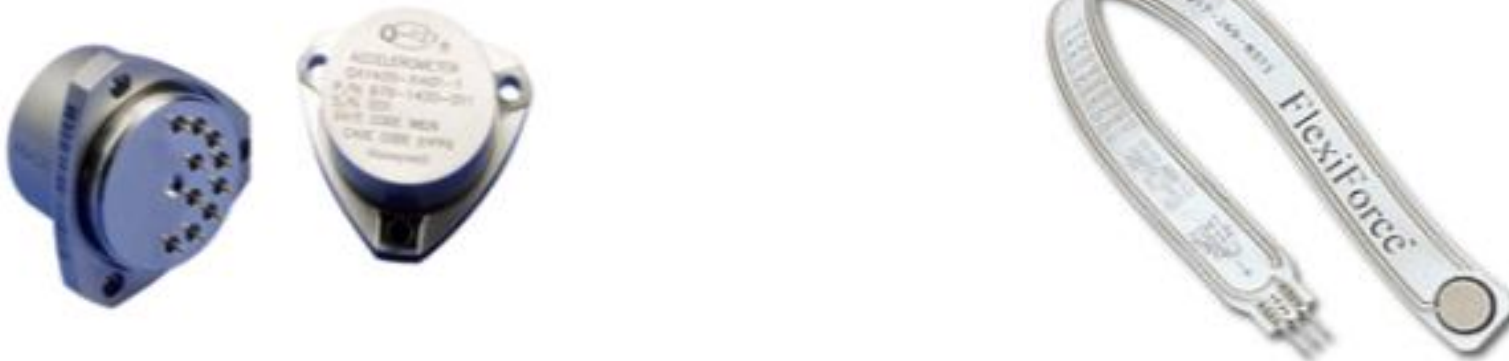


Robot Mechanism



Sensors

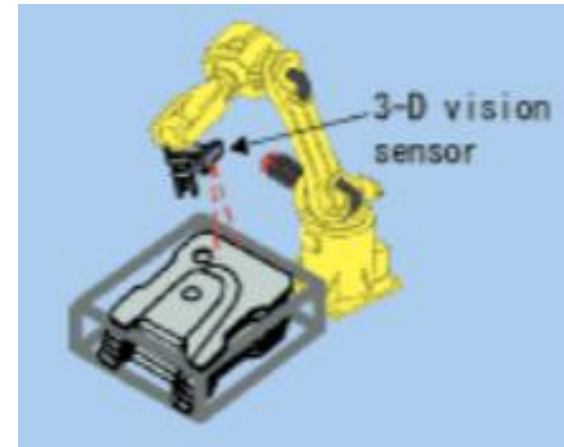
1. •Human senses: sight, sound, touch, taste, and smell provide us vital information to function and survive
2. •Robot sensors: measure robot configuration/condition and its environment and send such information to robot controller as electronic signals (e.g., arm position, presence of toxic gas)
3. •Robots often need information that is beyond 5 human senses (e.g., ability to: see in the dark, detect tiny amounts of invisible radiation, measure movement that is too small or fast for the human eye to see)



Vision Sensor

Vision Sensor: e.g., to pick bins, perform inspection, etc

Part-Picking: Robot can handle In-Sight Vision Sensors work pieces that are randomly piled by using 3-D vision sensor. Since alignment operation, a special parts feeder, and an alignment pallette are not required, an automatic system can be constructed at low cost.



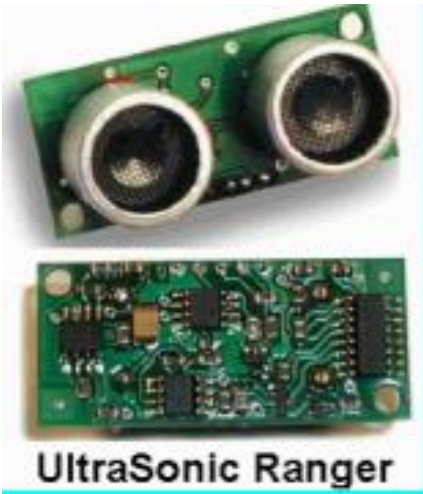
Force Sensors

Force Sensor: e.g., parts fitting and insertion, force feedback in robotic surgery

Parts fitting and insertion: Robots can do precise fitting and insertion of machine parts by using force sensor. A robot can insert parts that have the phases after matching their phases in addition to simply inserting them. It can automate high skill jobs



Proximity Sensors



UltraSonic Ranger

- 6 ultrasonic sonar transducers to explore wide, open areas
- Obstacle detection over a wide range from 15cm to 3m
- 16 built-in infrared proximity sensors (range 5-20cm)
- Infrared sensors act as a “virtual bumper” and allow for negotiating tight spaces

Tilt Sensor

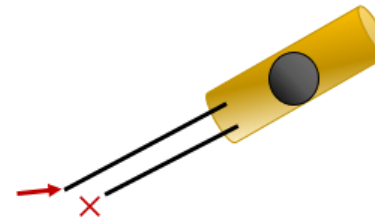


Sensor upright



Current flows

Tilted sensor



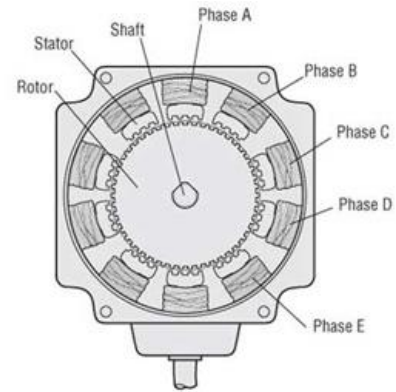
Current doesn't flow

Actuators / Muscles

- Common robotic actuators utilize combinations of different electro-mechanical devices
 - – Synchronous motor
 - – Stepper motor
 - – AC servo motor
 - – Brushless DC servo motor
 - – Brushed DC servo motor



Actuators



Motor Structural Diagram: Cross-Section Perpendicular to Shaft



Controller

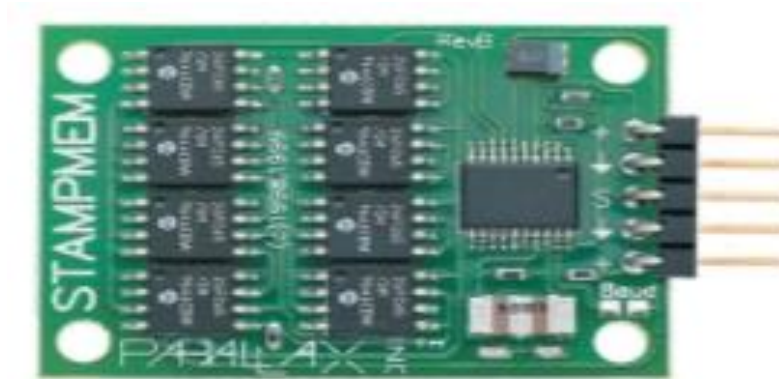


- Provide necessary intelligence to control the manipulator/mobile robot
- Process the sensory information and compute the control commands for the actuators to carry out specified tasks



Storage Hardware

- Storage devices: e.g., memory to store the control program and the state of the robot system obtained from the sensors



Computer Hardware

- Computational engine that computes the control commands



Interface Hardware

- Interface units: Hardware to interface digital controller with the external world (sensors and actuators)



AC to DC



Operational Amplifiers

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

THANK YOU!

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