CSCE 274 Robotic Applications and Design
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History of robotics

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Outline

- Robots' timeline
- Robots' classification
- Contributing disciplines

Talos

- Earliest reference to robot in Greek mythology

Source: ancient-origins.net

Ancient Mechanisms

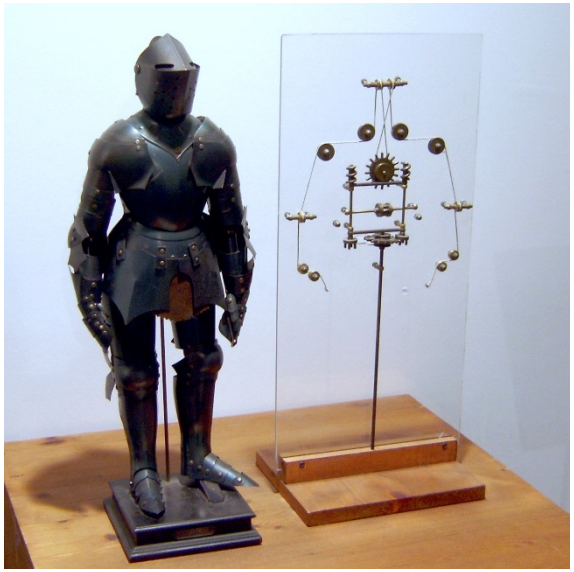
Odometer

Wine Serving

Complex Mechanism

Leonardo's robot

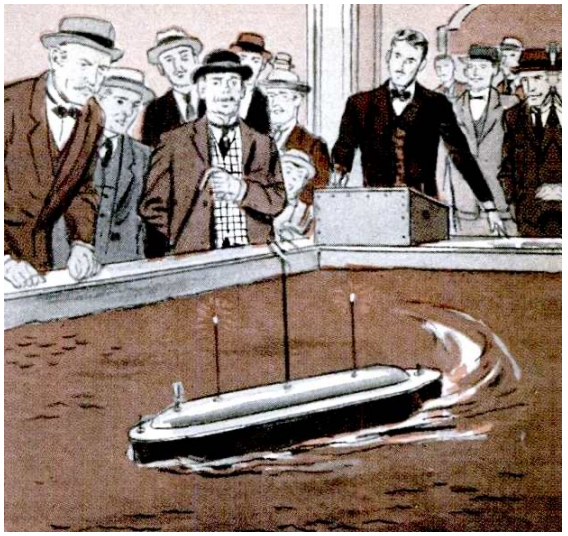
- Humanoid automaton designed and constructed by Leonardo da Vinci in 1495



Source: wikipedia.org

Tesla radio boat

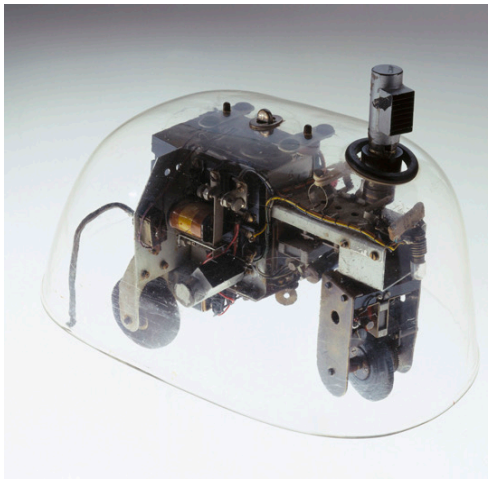
- First teleoperated boat with radio antenna in 1898 by Nikola Tesla



Source: bluebird-electric.net

Tortoise

- The first mobile robot (1948) by Grey Walter
  - Reactive autonomous robots that could wander and avoid obstacles
  - Two simulated neurons
- Setup
  - 1 photocell, 1 bump sensor, 1 motor, 3 wheels, 1 battery



Source: sciencemuseum.org.uk

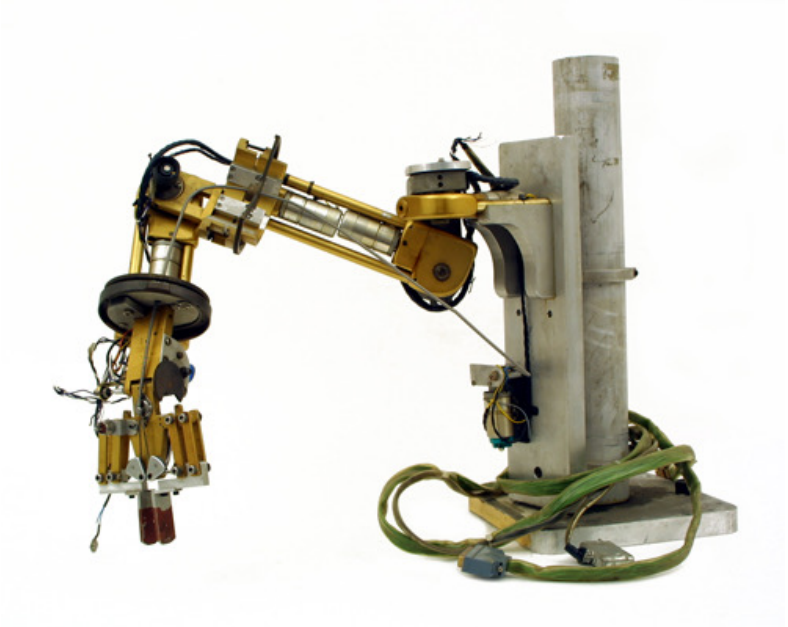
UNIMATE

- The first industrial robot, UNIMATE, in 1954
  - Designed by George Devol, who coins the term Universal Automation
  - Name shortened to Unimation, which becomes the name of the first robot company (1962)

Source: robotics.org

Rancho Arm

- The first artificial robotic arm to be controlled by a computer was designed in 1963 in a hospital in California



Source: computerhistory.org

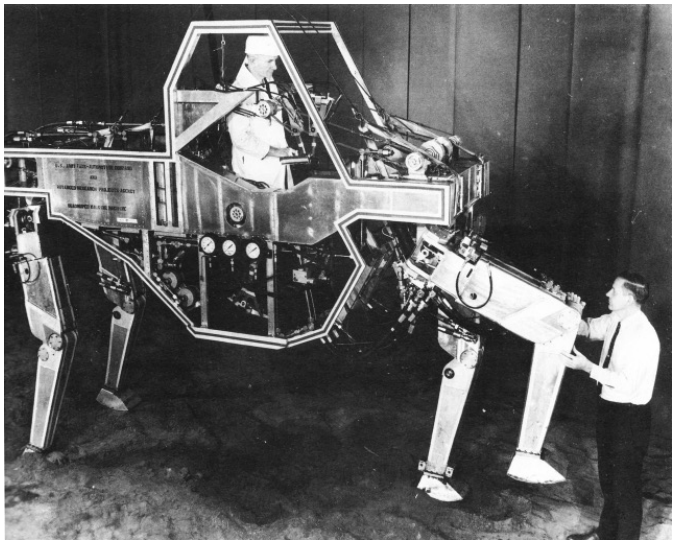
Tentacle arm

- Developed at MIT by Marvin Minsky in 1968
  - Twelve joints and could be controlled by a PDP-6 computer or via a joystick

Source: cyberneticzoo.com

GE Walking truck

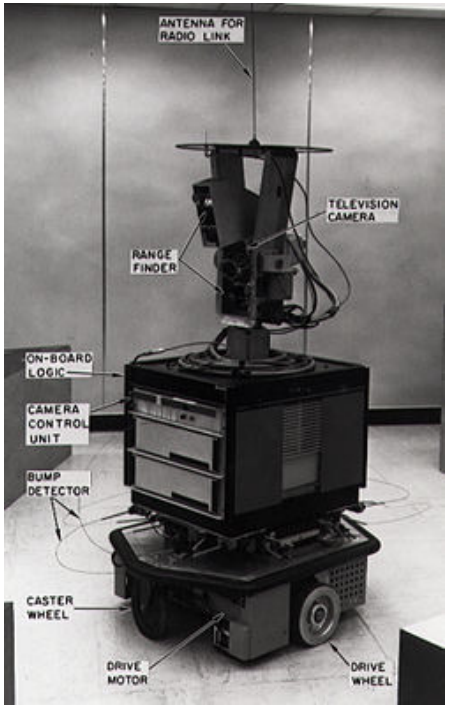
- Most famous early legged vehicles in 1969
  - Controlled by an on-board operator

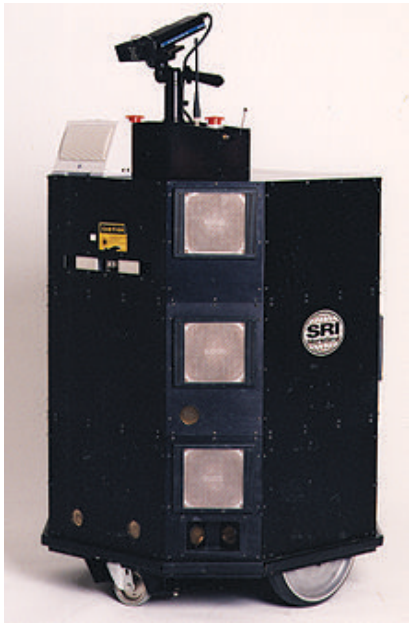


Source: cyberneticzoo.com

Shakey/Flakey

- First general-purpose mobile robot in 1972 from Stanford Research Institute
  - Logical, goal-based agent
  - Programming in LISP
  - antenna for a radio link, sonar range finders, a television camera, on-board processors, and collision detection sensors
- Flakey, successor of Shakey 1985
  - 2 sonar sensors, optical wheel encoders, a video camera, and a depth-finding laser





Source: wikipedia.org

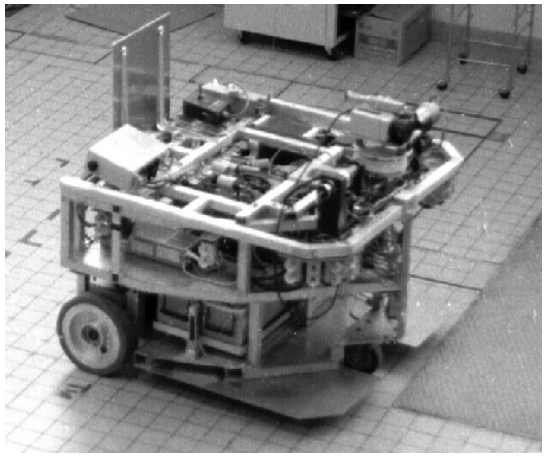
Silver arm

- David Silver designs the silver arm in 1974
  - Touch and pressure sensors for delicate assembly

Source: computerhistory.org

HILARE

- HILARE developed at LAAS in Toulose, France, in 1977
  - Vision, ultrasound, laser rangefinder
  - Differential drive system

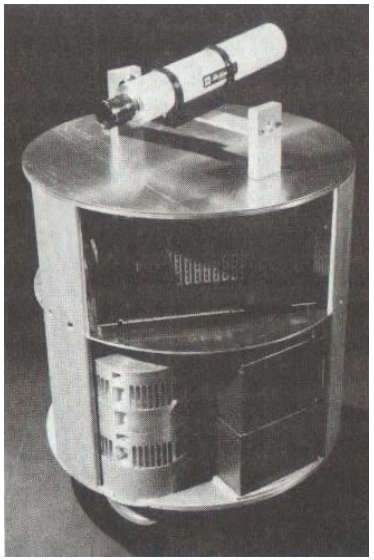


Source: laas.fr

CART/Rover

- CART developed at Stanford, latest version 1979
  - Off-board computer, stereo camera
  - Motion similar to car
- Rover developed at CMU in 1983
  - Additional infrared and sonar proximity sensors, and pan/tilt system for the camera
  - Synchronous drive-like

Source: stanford.edu



Source: cyberneticzoo.com

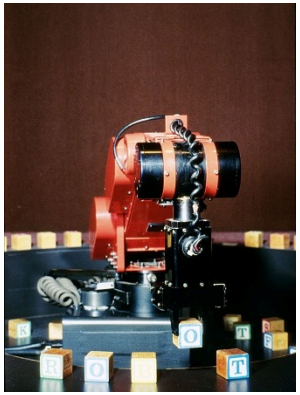
Robots bloom from 1980

FRED robot
(1982)

Heathkit
Hero Jr. robot
(1984)

Denning
sentry robot
(1985)

Omnibot
2000 (1985)



Mitsubishi
Movemaster RM-501
Gripper (1987)

Source: computerhistory.org

MQ-1 predator drone

- UAV built by General Atomics in 1994

Source: computerhistory.org

AIBO

- Sony develops AIBO, robotic pet dog, in 1999

Source: computerhistory.org

Honda ASIMO

- Honda's Advanced Step in Innovative Mobility (ASIMO) humanoid robot is introduced in 2000

Source: computerhistory.org

DARPA Centibots

- The Centibots project was funded by the Defense Advanced Research Projects Agency (DARPA) in 2002
  - Coordination of 100 bots to map dangerous areas

Source: computerhistory.org

iRobot Roomba

- First vacuum cleaner introduced by iRobot in 2002

Source: computerhistory.org

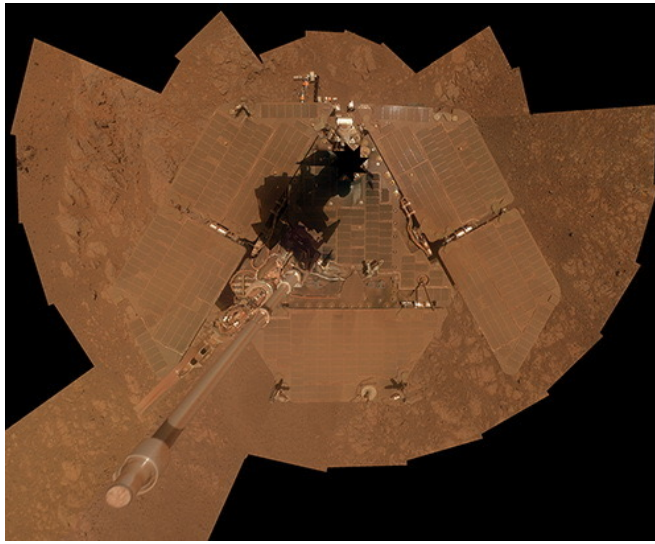
Aldebaran NAO

- Small humanoid developed in 2004 for research and education

Source: ald.softbankrobotics.com

Spirit and Opportunity Mars Rovers

- Rover, designed by NASA/JPL-Caltech, in 2004, sent to Mars to explore the planet



Source: computerhistory.org

Stanford Stanley

- Stanford Stanley autonomous car wins the 2005 DARPA Grand Challenge

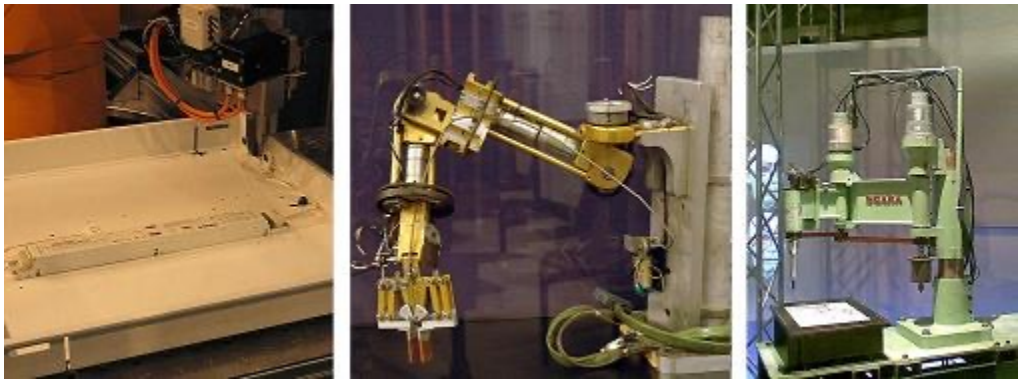
Source: computerhistory.org

Summarizing

- Before 20th century: mechanical automata
- After 1940: first reactive robot
- After 1950: industrial robot for automation and research robots
- After 1980: company working on robots and research on intelligence, autonomy, and cooperation

Type of robots

- Robotic arms



Source: wikipedia.org

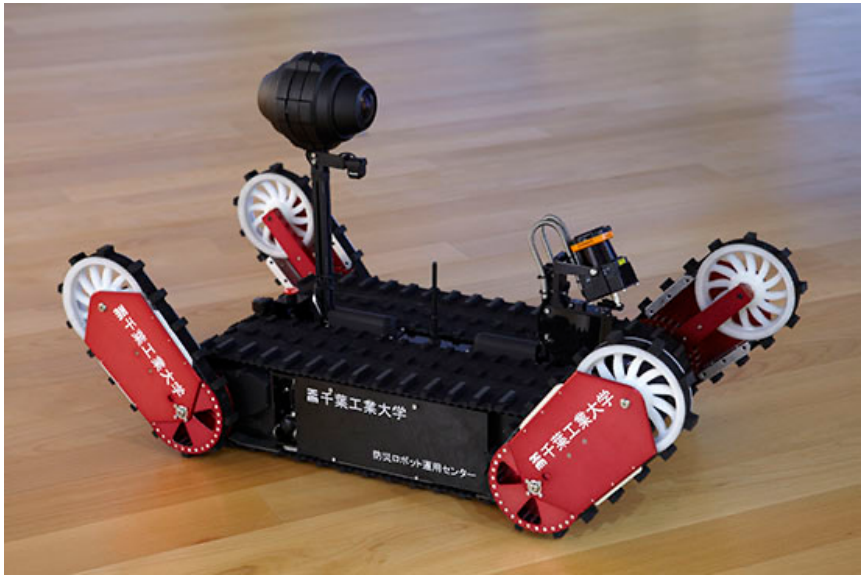
Type of robots

- Mobile robots
  - Wheeled robots

Source: mobilerobots.com

Type of robots

- Mobile robots
  - Wheeled robots
  - Tracked robots



Source: furo.org

Type of robots

- Mobile robots
  - Wheeled robots
  - Tracked robots
  - Legged robots

Source: bostondynamics.com

Type of robots

- Mobile robots
  - Wheeled robots
  - Tracked robots
  - Legged robots
  - Hybrid robots

Source: nasa.gov

Type of robots

- Flying robots
  - Copter

Source: wikipedia.org

Type of robots

- Flying robots
  - Copter
  - Fixed-wing

Source: aerialdatasystems.com

Type of robots

- Aquatic robots
  - Boat

Source: clearpathrobotics.com

Type of robots

- Aquatic robots
  - Boat
  - Swimming

Source: mcgill.ca

Type of robots

- Aquatic robots
  - Boat
  - Swimming
  - Crawling robots

Source: designworldonline.com

Type of robots

- Aquatic robots
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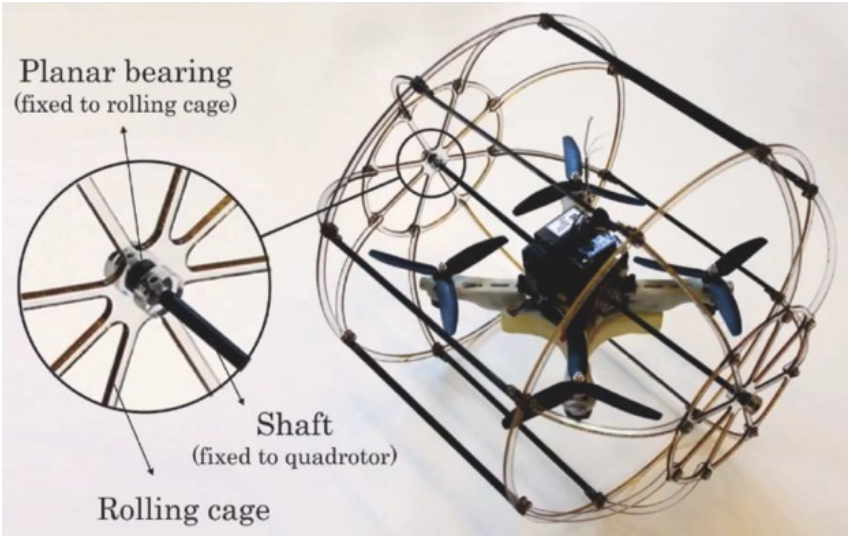


Source: engadget.com

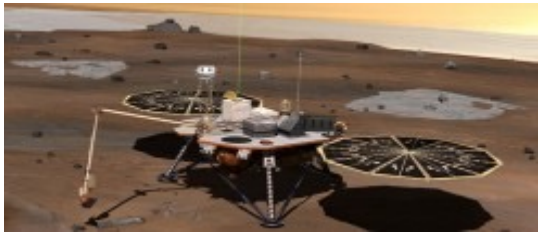
Space Robots

- Arms (CanadArm, CanadArm 2)

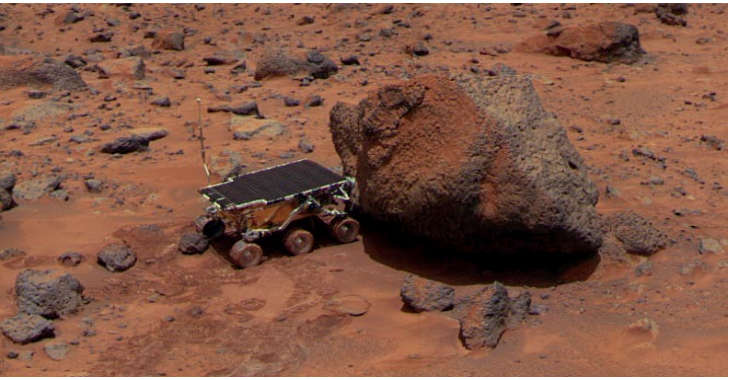
Space Robots

- Arms
- Rovers

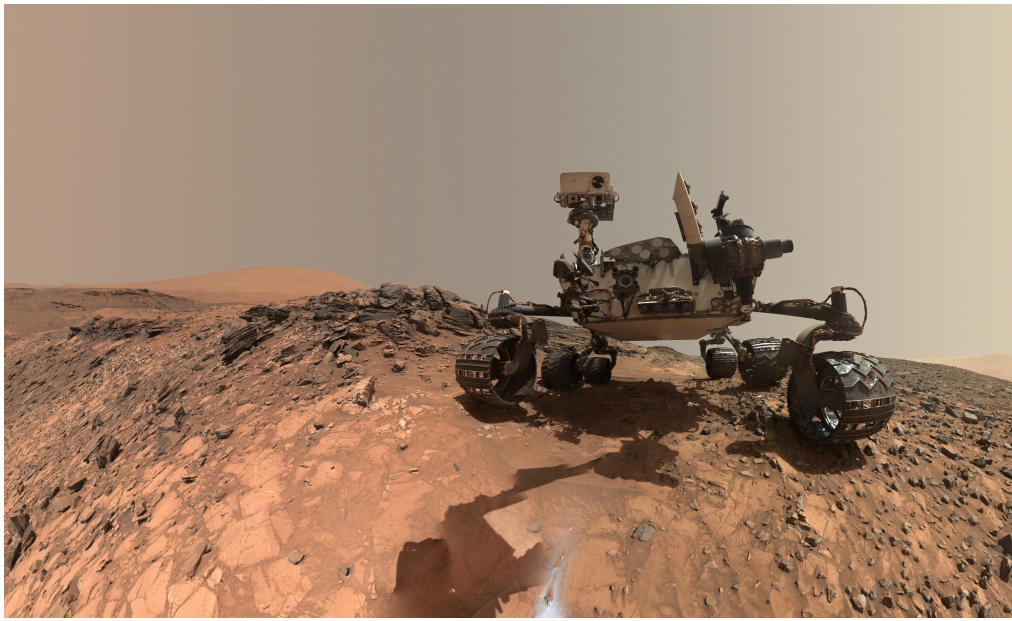
Spirit



Phoenix



Sojourner



Curiosity

Robot classification

- Mobility
- Architecture
- Level of autonomy
- …

Parts of a robot

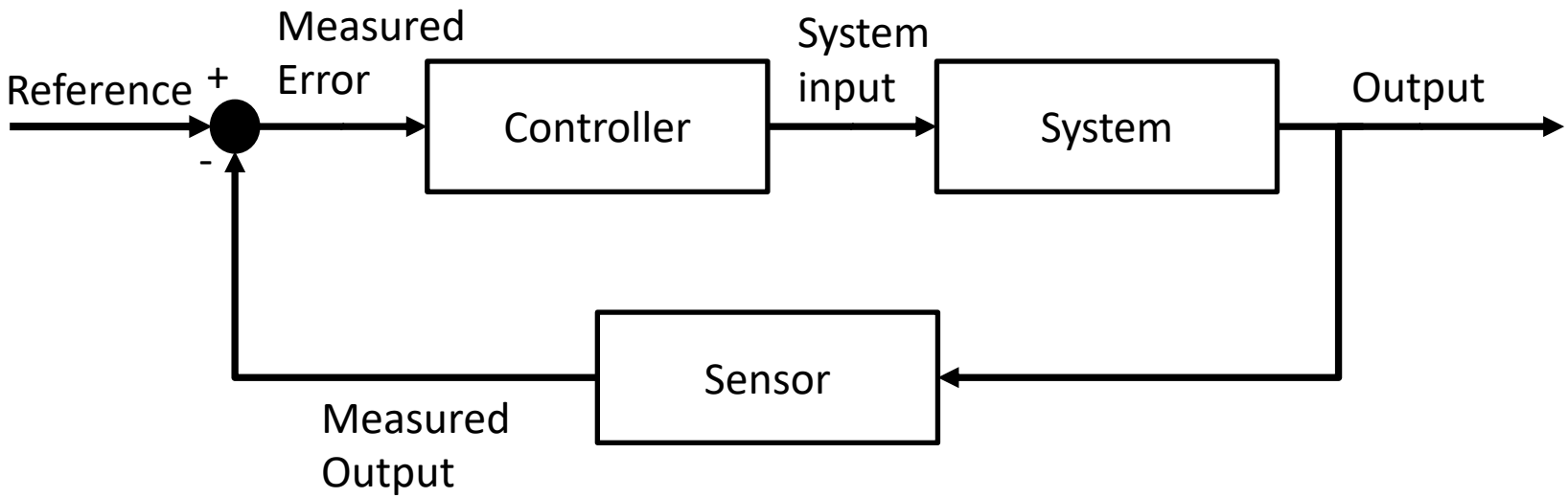
- Actuators
- Sensors
- Computing unit
- Battery/power consumption
- Communication

Disciplines

- Disciplines that contributed to the rise of robotics
  - Control theory
  - Cybernetics
  - Artificial intelligence

Control theory

- Control theory studies the behavior of systems whose behavior is governed by one or more inputs



Cybernetics

- Cybernetics studies and compare communication and control processes in biological and artificial systems
  - It focuses on *biomimetic* or *bio-inspired* robots

Artificial Intelligence

- Artificial intelligence is a research area that strives for combining science and engineering to make intelligent machines
  - In robotics, it focuses on internal models and representations
  - Algorithms for reasoning and planning use these models