Development of intelligent systems (RInS)

Introduction

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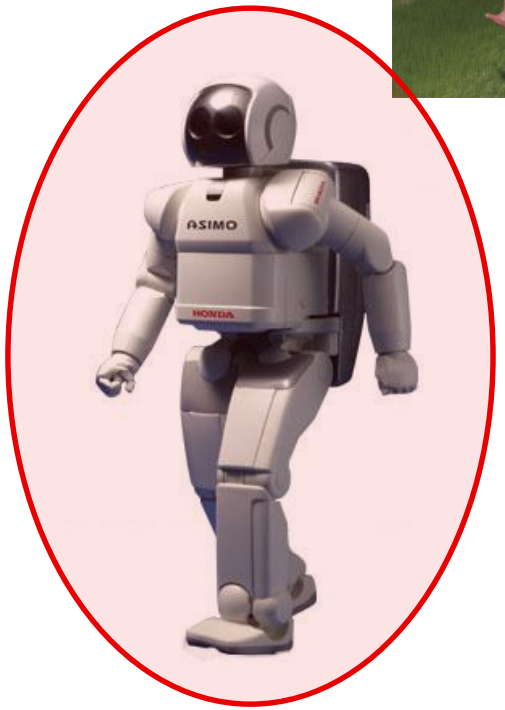
Intelligent systems

- Software intelligent systems
- Passive situated robot systems
- Active embodied robot systems

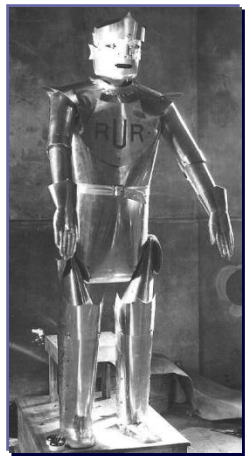


Robotics

ro·bot ***noun*** \ˈrō-ˌbät, -bət\: a real or imaginary machine that is controlled by a computer and is often made to look like a human or animal
: a machine that can do the work of a person and that works automatically or is controlled by a computer

Merriam – Webster dictionary

- Robot
  - Karel Čapek: R.U.R. (Rossum's Universal Robots), 1921
  - „robota“ – work; forced, hard labour



Intelligent autonomous robot systems

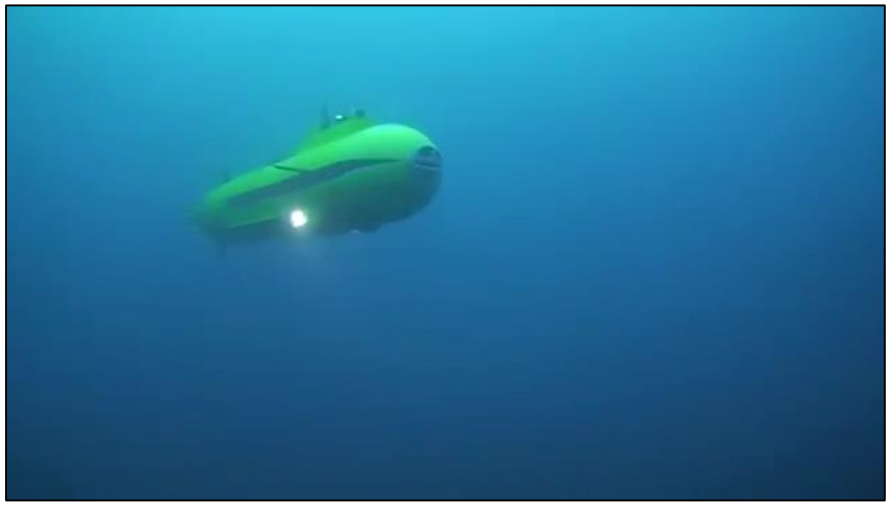
Drive

Walk

Intelligent autonomous robot systems

Float

Dive



Intelligent autonomous robot systems

Fly

Surround us

Types of robots

- Industrial robots
- Robot manipulators
- Mobile robots
- Humanoid robots
- Cognitive systems
- Unmanned aerial vehicles, ...

Industrial robots

Domestic robots

Autonomous car navigation

- Autonomous navigation
  - Self-driving cars

- Navigation assistants
  - Pedestrian detection
  - Several cameras + other sensors

http://www.mobileye.com

Bloomberg, Uber self-driving car

Autonomous boat navigation (USV)

UNI-LJ, FE, LSI
FRI, LUVSS
Harhpa Sea

Autonomous drones (UAV)

UNI-LJ, FRI, LUVSS

Cognitive robotics

- Wikipedia:

  Cognitive robotics is concerned with endowing **robots** with mammalian and **human-like cognitive capabilities** to enable the achievement of complex goals in complex environments. Robotic cognitive capabilities include **perception processing, attention allocation, anticipation, planning, reasoning about other agents**, and perhaps reasoning about their **own mental states**. Robotic cognition embodies the **behaviour of intelligent agents** in the **physical world**.

- A cognitive robot should exhibit:
  - knowledge
  - beliefs
  - preferences
  - goals
  - informational attitudes
  - motivational attitudes (observing, communicating, revising beliefs, planning)

Cognitive systems

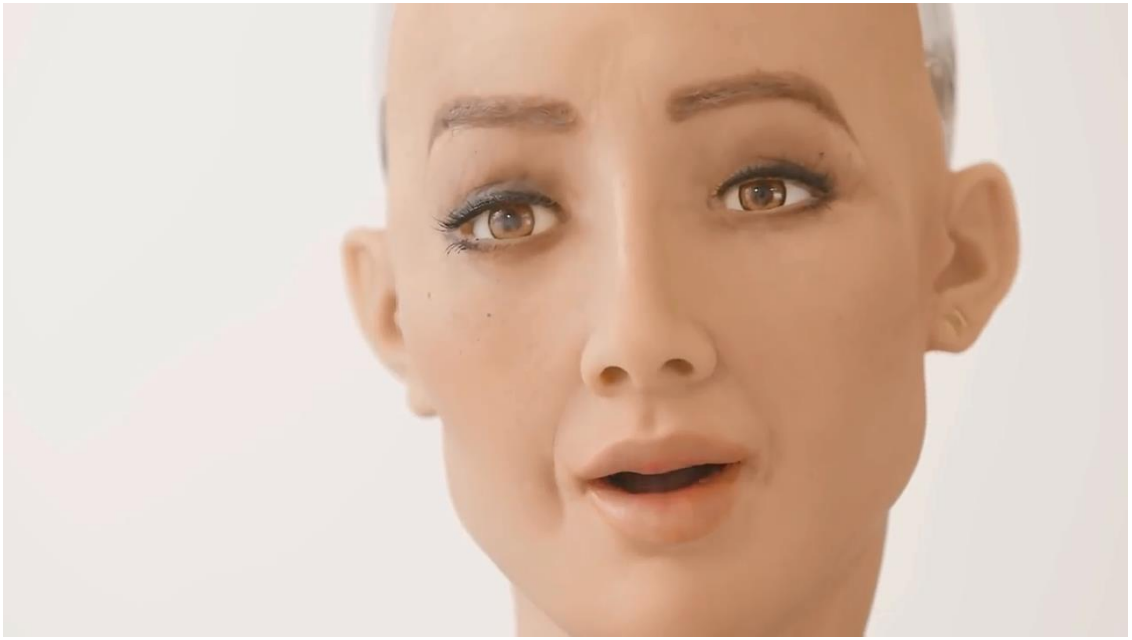
- Cognitive assistant
  - Explores the environment and builds a map of it
  - Learns to recognize and identify objects
  - Understand object affordances
  - Can verbally and non-verbally communicate with people in its vicinity
  - Detects new situations and reacts accordingly

- Built-in basic functionalities, which are then further developed, adapted and extended by learning

Morpha

Univ. Karlsruhe

Cognitive systems



Intelligent robot systems

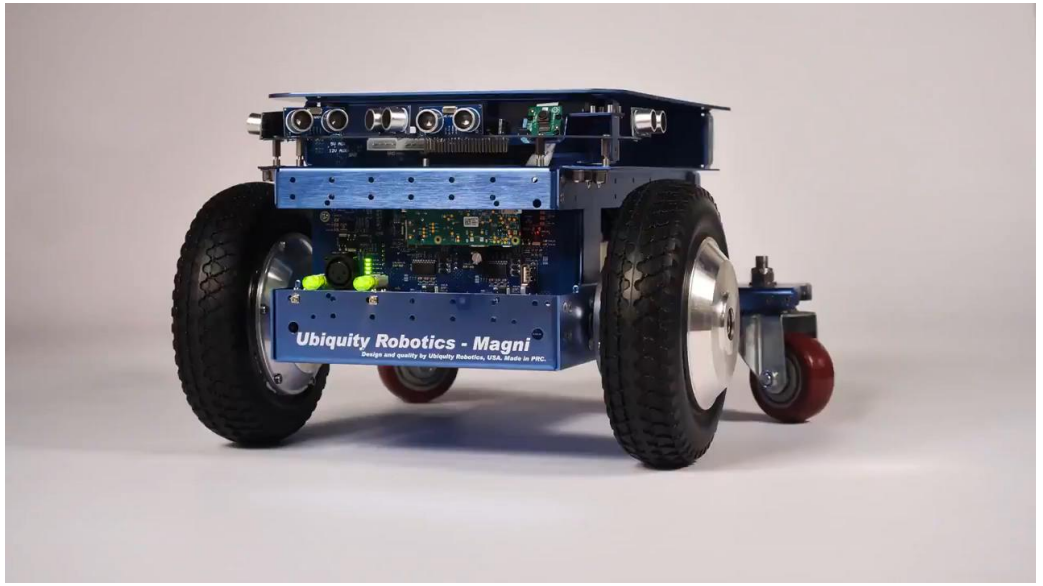
UL FRI

Mobile robots

EURON video

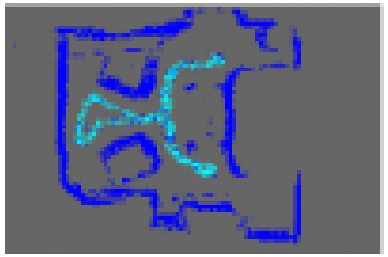
Mobile robots

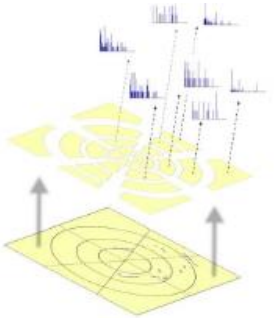
IRobot Roomba TurtleBot



Ubiquity robotics Magni

Mobile robots





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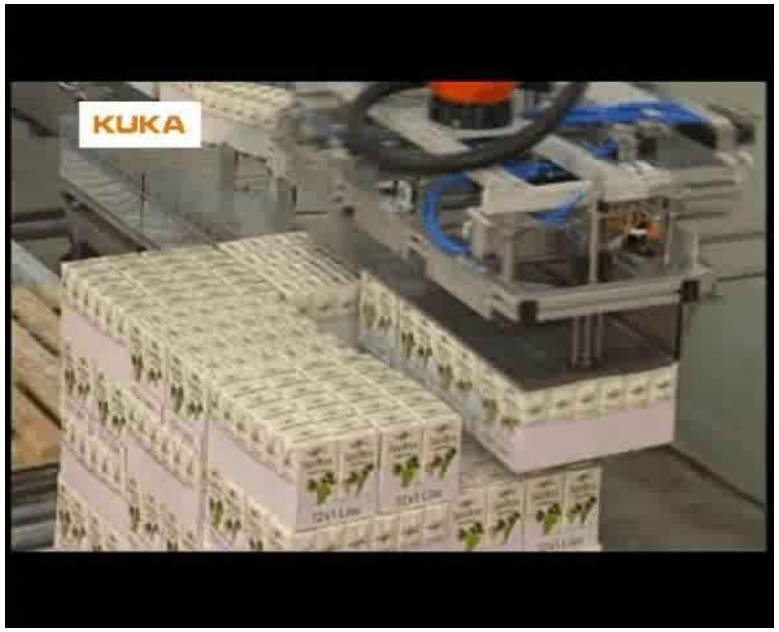
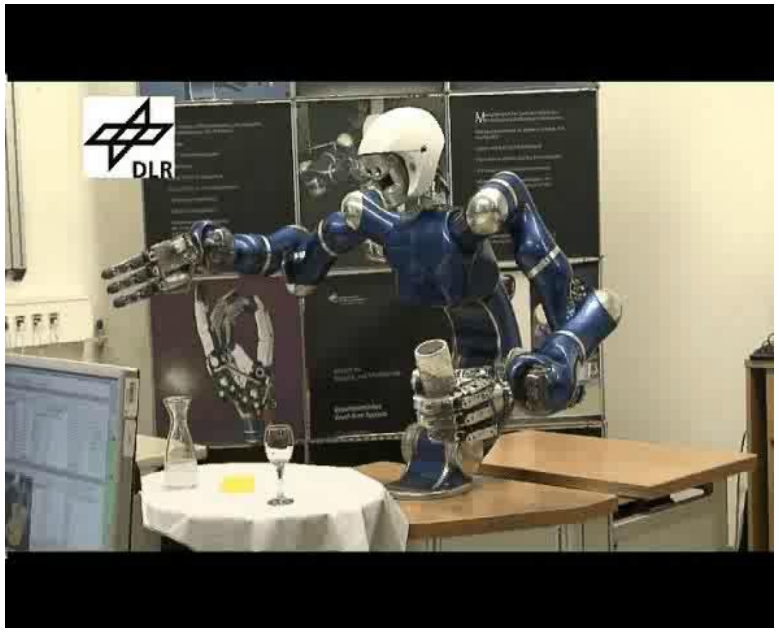
Robotics

- Routine industrial robotic sensor system



EURON video

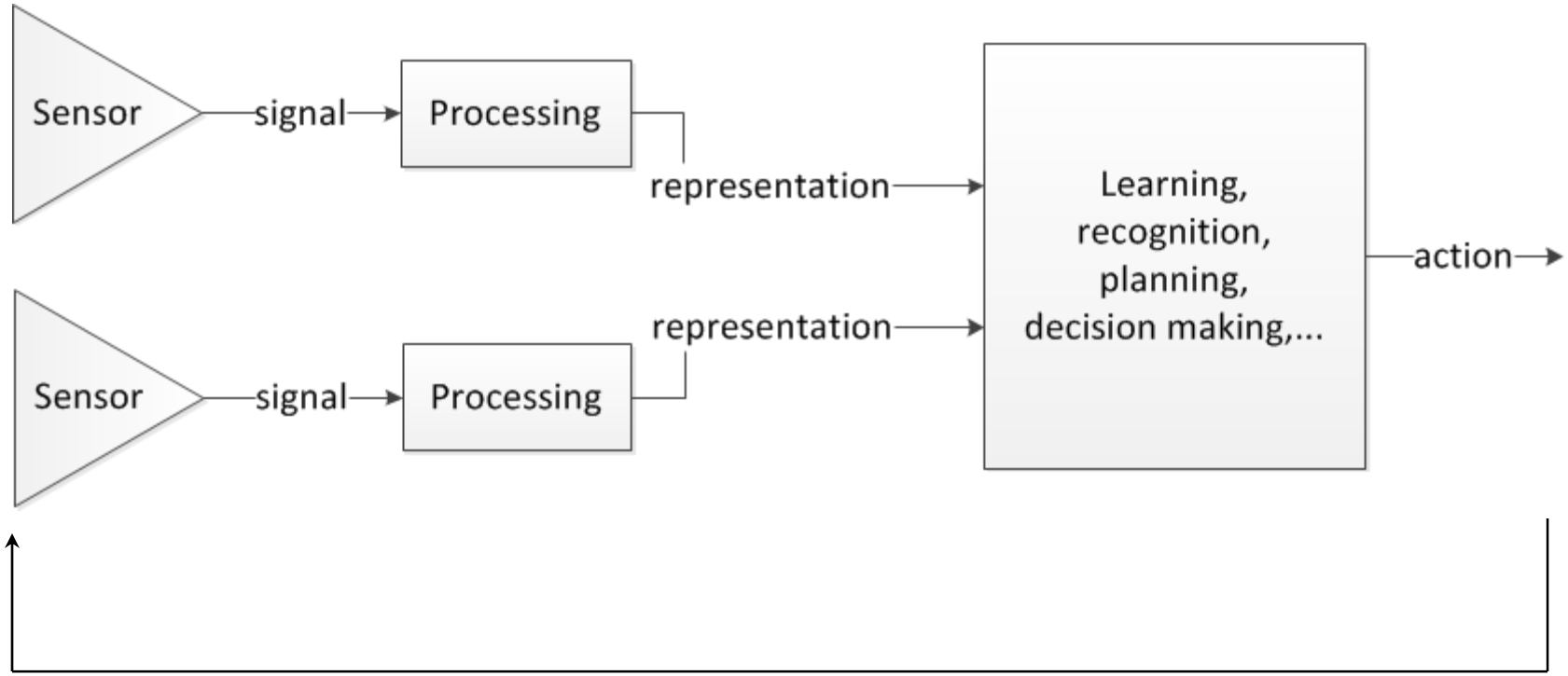


EURON video

- Intelligent artificial visual cognitive systems

Sensor-robot system

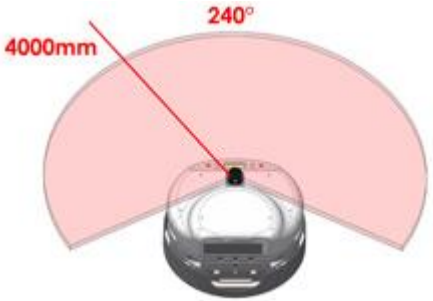
- Perception – action cycle

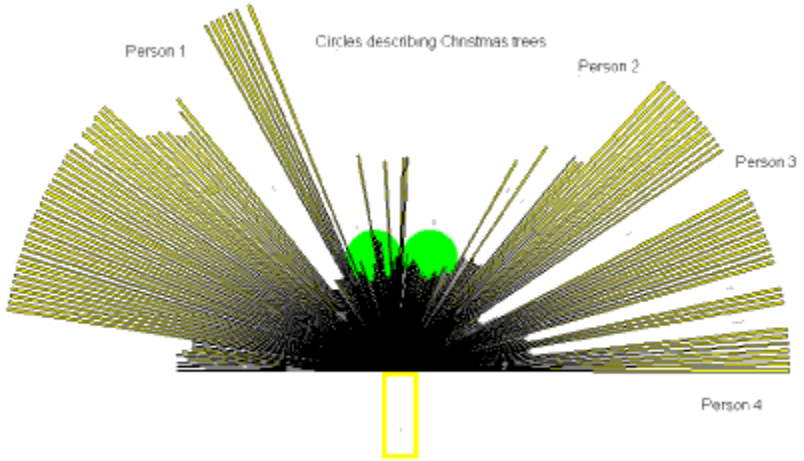


Simulation of robot perception and control

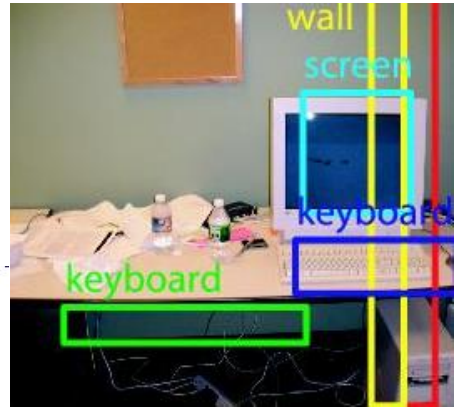
Sensors

- Range sensors





- Object recognition

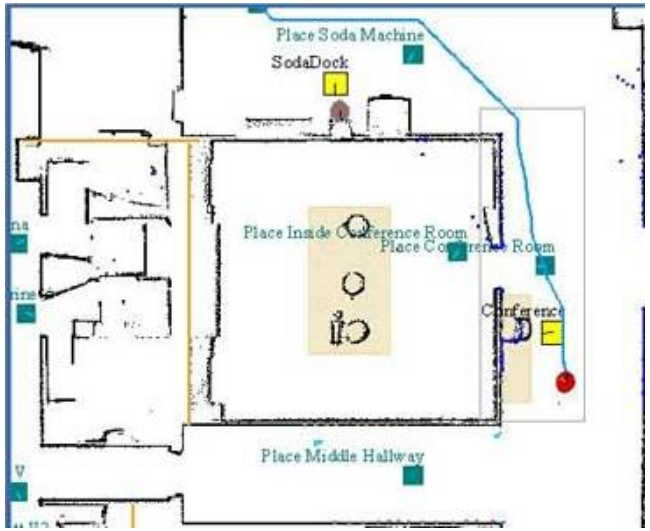


- Bumper – collision detector

- Odometer

Planning and control

- Planning



- Control