

UV LARM

**Logiciel et Architecture pour la
Robotique Mobile**

An introduction

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- 1. What is a Robot ?**
- 2. About the UV LARM**
- 3. Today: First contact with Linux and ROS**

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What is a Robot ?

On Wikipedia:

en

"A robot is a machine—especially one programmable by a computer— capable of carrying out a complex series of actions automatically."

fr

"Un robot est un dispositif mécatronique (alliant mécanique, électronique et informatique) conçue pour accomplir automatiquement des tâches imitant ou reproduisant, dans un domaine précis, des actions humaines."

What is a Robot ?

From my point of view

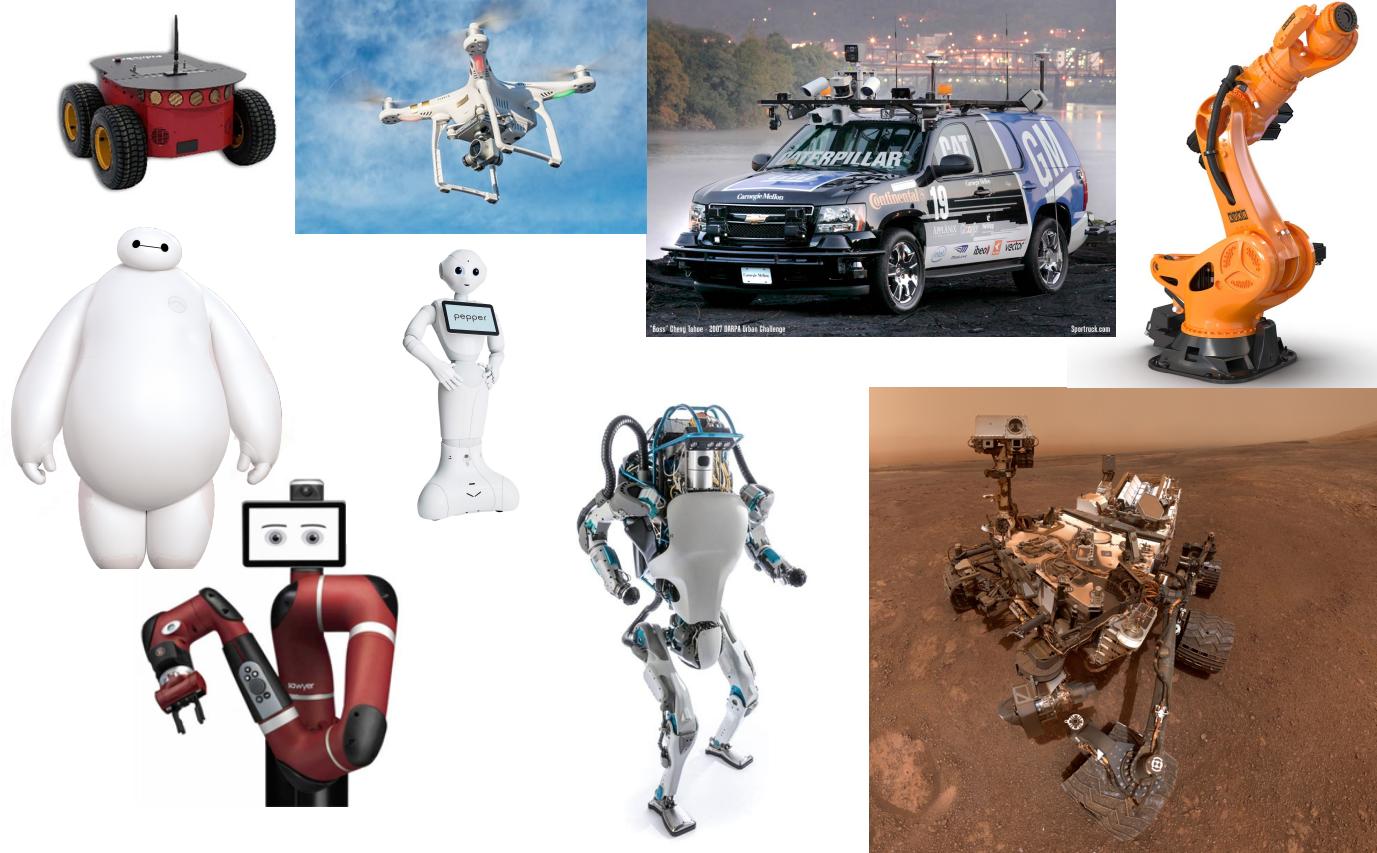
"A **robot** is a **mechatronics** machine capable of autonomously acting in a real environment."

- ▶ perceives with *sensors*
- ▶ models its environment and adapts its behavior
- ▶ acts with *actuators*

generally involves Artificial-Intelligence:

- ▶ capable to mimic natural (human, animal, insect,...) intelligence

Some examples



Macro: a large variety of robots

Some examples



Micro: a large variety of components.

From a mechanic point of view

Focus on:

- ▶ Resistance
- ▶ Weight
- ▶ Distortion
- ▶ Vibration absorption
- ▶ Machining, Assembly

for different robots:

- ▶ Fast
- ▶ Precise
- ▶ Strong
- ▶ resistant (dust, water,...)
- ▶ safe
- ▶ less expensive

From an electronic point of view

Focus on sensors, motor, energy systems and hardware.

From a automation point of view

Focus on:

- ▶ Physics science
- ▶ Signal processing
- ▶ Control system

by manipulating

- ▶ Times series, torques
- ▶ Vector, Matrices

From a software point of view

Focus on:

- ▶ Algorythms
- ▶ Knowledge representation
- ▶ Artificial intelligence
- ▶ Software architecture

Robots are complex and singular systems

which require modular computer programs.

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Software and Architecture for Mobile Robots

Mostly about: autonomous navigation.

- ▶ Communicate with robot components
- ▶ Control robot movements (nonholonomic robot)
- ▶ Perception of the local environment (laser, vision)
- ▶ SLAM (Simultaneous Localization and Mapping)
- ▶ Path finding and navigation.

Software and Architecture for Mobile Robots

With a central need: modular software

- ▶ An expected complex global behavior
- ▶ Splited in piece of programs (modules)
- ▶ Communicating together
- ▶ With dedicated tasks (sensor driver, representation, planning, controling...)
- ▶ And a bunch of tools making all working together...

UV-LARM - Schedule

1st week: Introduction, simulation and movement.

2d week: Vision and Mapping.

3d week: Challenge as your project.

4th week: Evaluation through the code you provide.

- ▶ Always from *9:00* to *12:00* and from *14:00* to *17:30*.
- ▶ In *Develter* and *3005*.
- ▶ With or without a teacher.

Using ROS API:

ROS: The Robot Operating System (ROS) is a set of *software libraries* and *tools* that help you build robot applications.

- ▶ The number one Robotic Middle Ware used in academic
- ▶ Open and oriented toward its *many contributors*
- ▶ Supported by a large number of professional companies

It permits thinking robotic programs in a modular way as independent programs: *nodes* working together by communicating through *topics*.

It comes with useful functionality like *frame* management and *transform*

ROS API:

Tools:

To start nodes, to connect them, to visualize the architecture and the data in the pipes (topics).

An API and Libs:

To develop its own nodes, to use topic-based communication, to help in manipulating spatio-temporal data.

A community:

To share our contribution and use the one from pairs wiki.ros.org

Why Ubuntu Linux:

Because

- ▶ We love *GNU* (and open source in general)
- ▶ ROS supports natively Ubuntu Linux
- ▶ *And mainly:* Linux is efficient and well documented

Evaluation:

3 Challenges

- ▶ Navigate in a cluttered environment.
- ▶ Map an unknown environment and retrieve treasures.
- ▶ Make autonomous exploration.

2 Environments

- ▶ Robot: Turtlebot
- ▶ Simulation: Gazebo

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Today:

Wiki ROS Beginner tutorials:

- ▶ Create a ROS project (catkin)
- ▶ Implement communicating nodes (publisher and subscribers)

But first : Let play a little with Linux and its Terminal:

- ▶ Setup tutorial on gitbook: <https://ceri-num.gitbook.io/uv-larm/>