PROJET ROMEO

ROMEO
Humanoid for Action and Communication

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Aldebaran Robotics

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ALDEBARAN Robotics

Overview

- French National Project labeled by Cluster Cap Digital
- Budget of 10M€
- Funding of 4.9M€
- Funded by:
  - French Government,
  - The Ile-de-France Region,
  - the City of Paris
- January 2009 – September 2012
- 13 partners

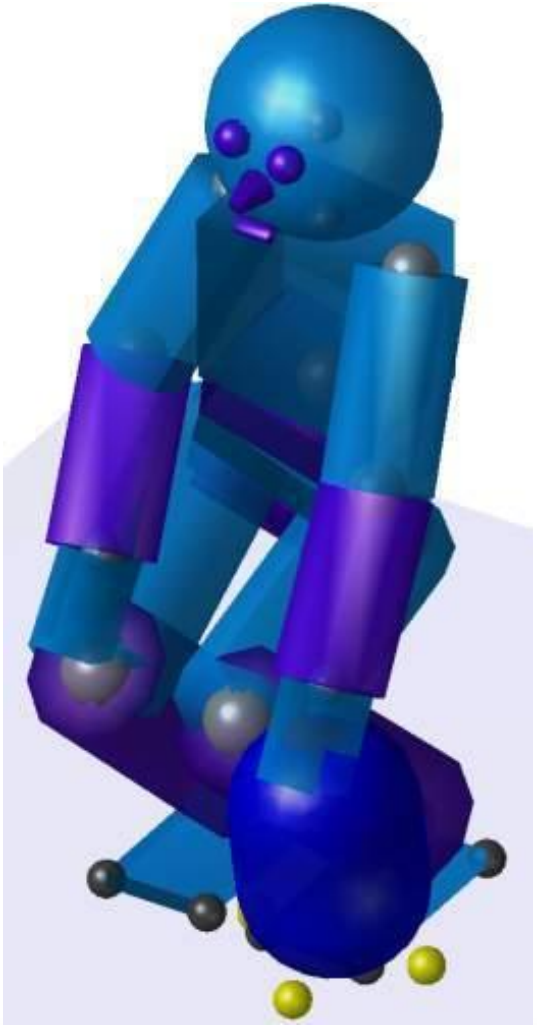
Aim: to design a human-size humanoid robot, a real personal assistant for independent living of elderly and disabled people

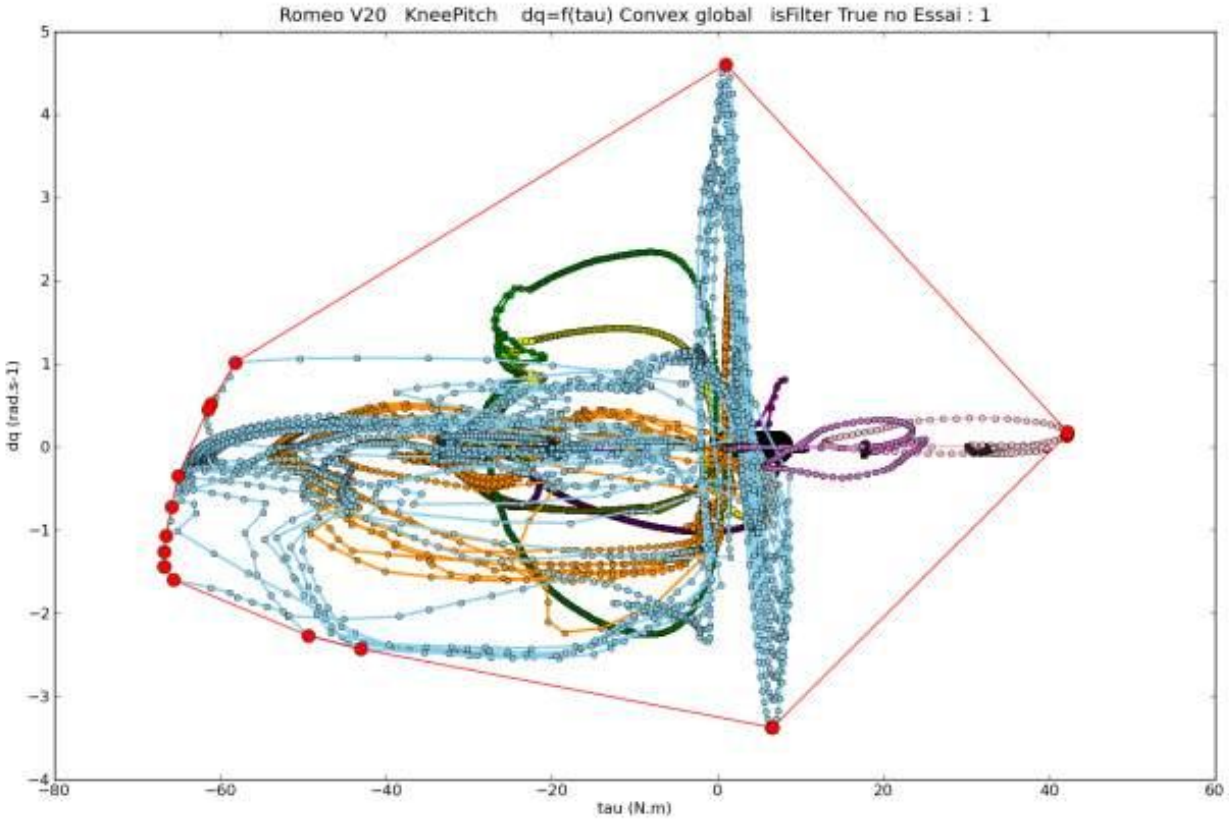
Partners (4 SME, 8 Laboratories, 1 Institute)

Scenario

- **Mr. Smith lives alone**
  - He is elder and visually impaired
- **The robot helps him in the daily life**
  - The robot understands his voice and his gestures
- **The robot plays with Mr. Smith's grand-children**
- **When Mr. Smith faints, the robot reacts**
  - Incident detection
  - Alert

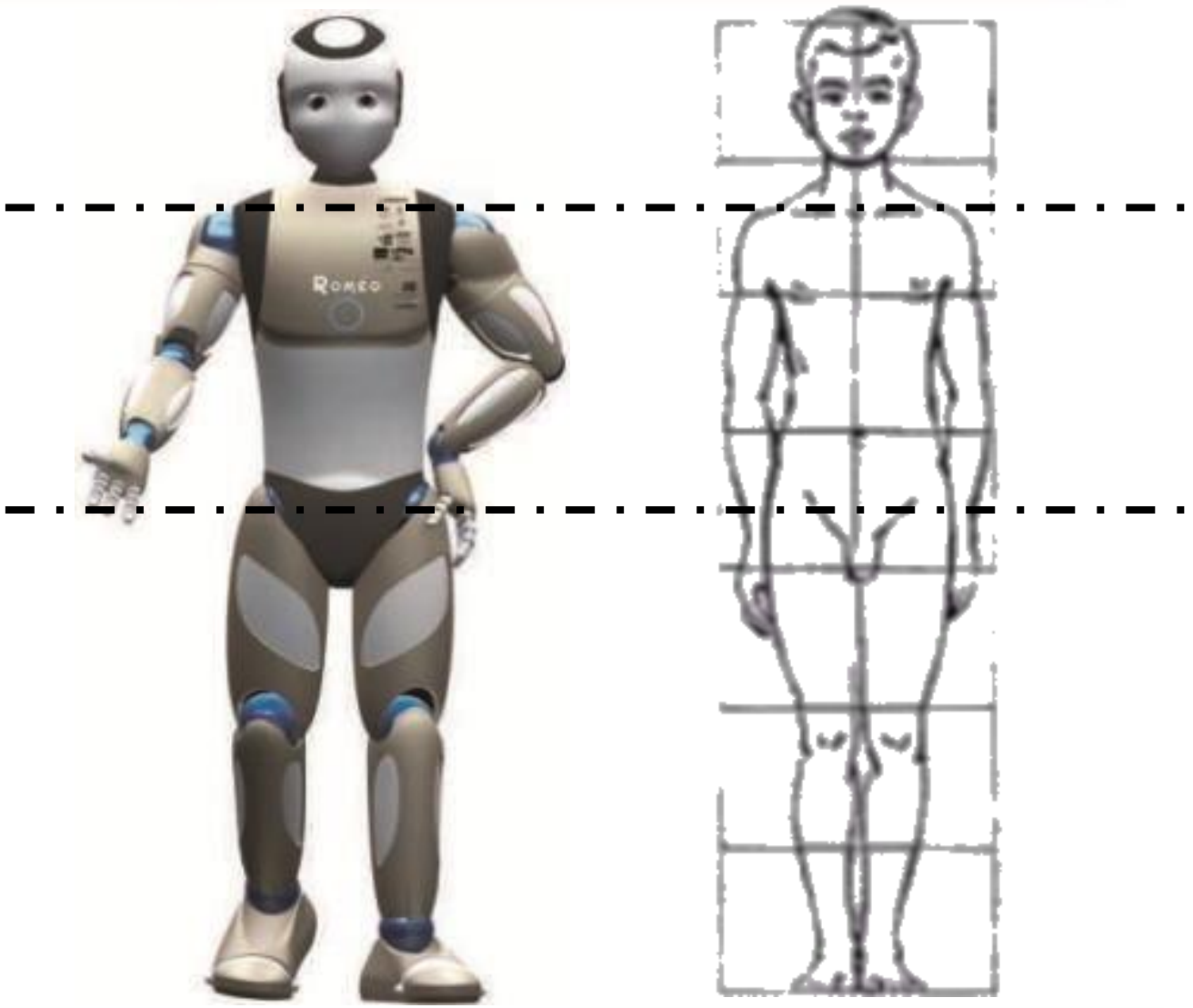
Dynamic modelling for dimensionning



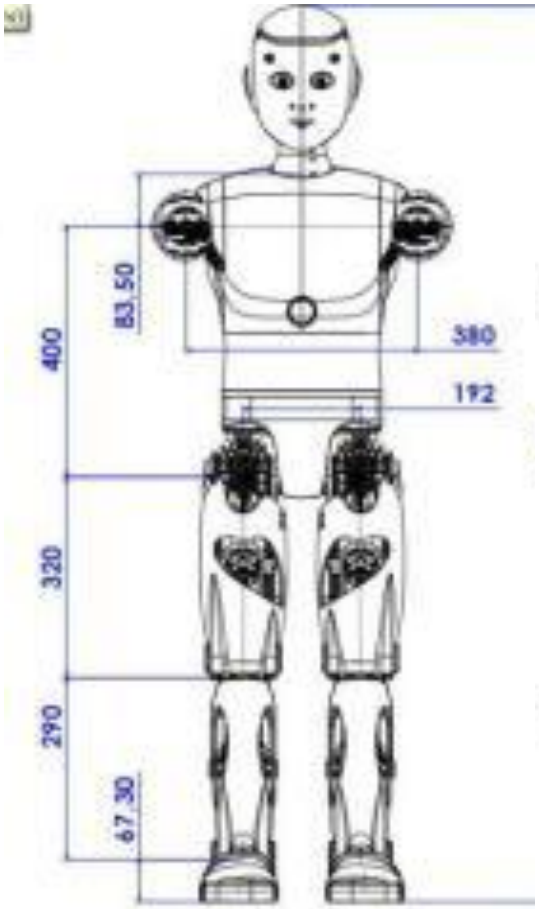


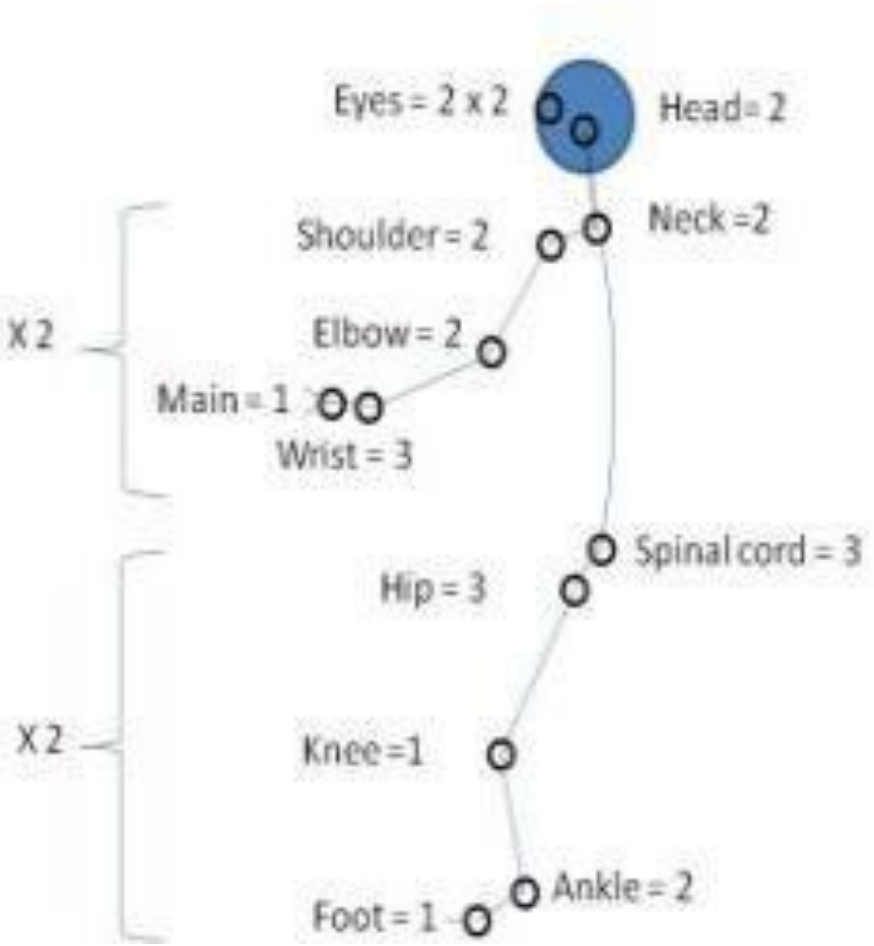
Selected Design

- Human like aspect
- 1,4m 40kg
- Vertebral column
- Exoskeleton on legs
- Partially soft torso
- Mobile eyes
- Fix mouth



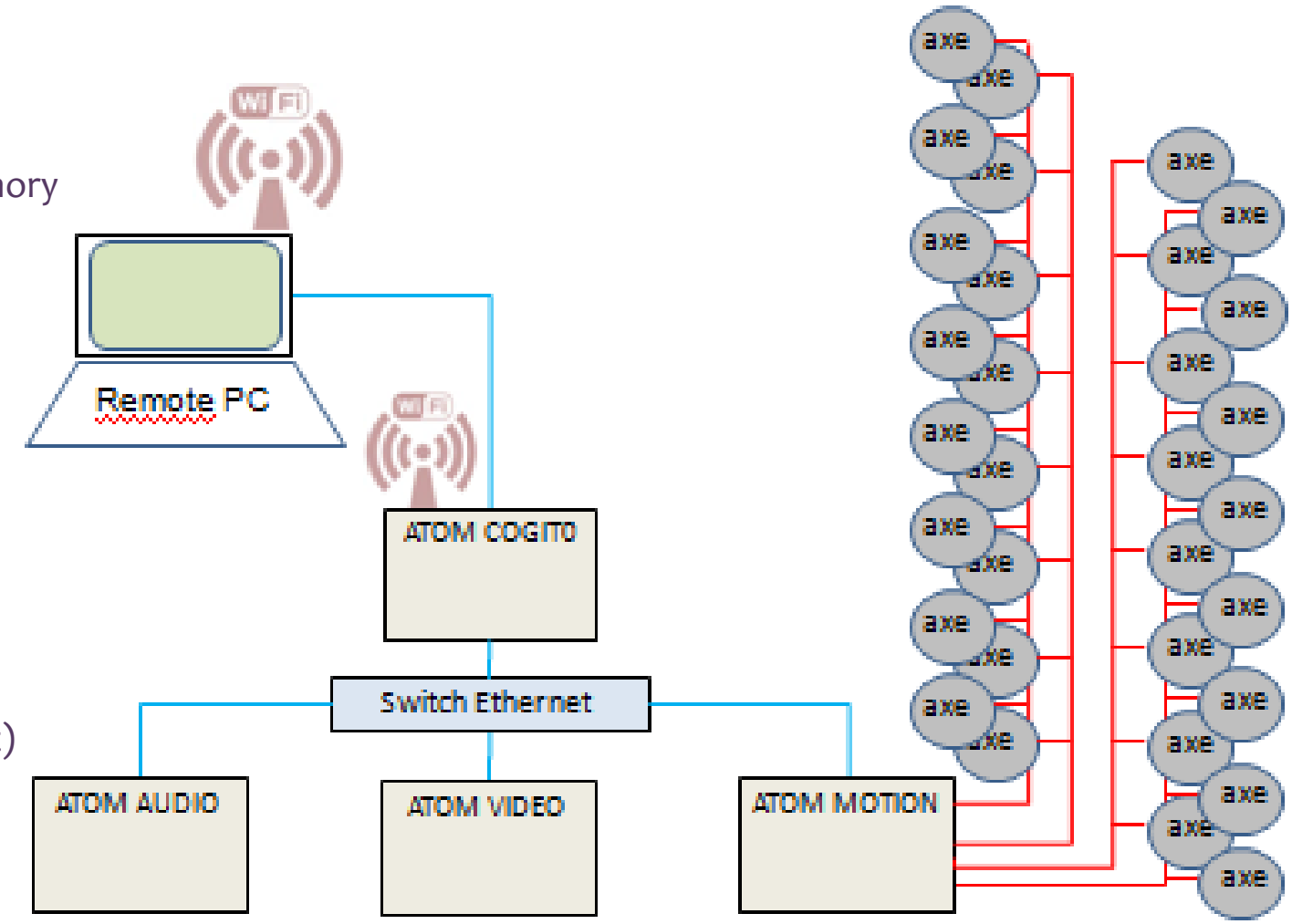
Kinematics : 37 DOF for the limbs + 4 for the eyes





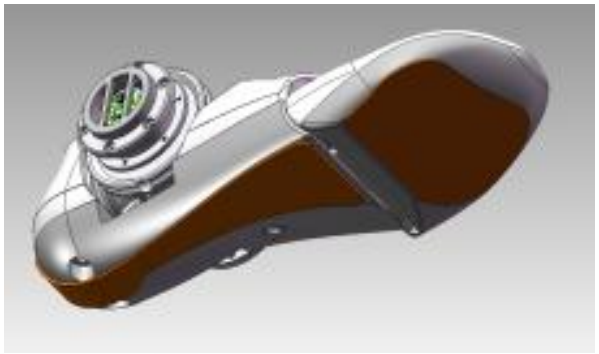
Electronic Architecture

- 4 x CPU
  - ATOM (Intel)
  - 1.6 GHz
  - 1 Gbyte on board memory
  - Gigabit Ethernet
- Sensors
  - 4 cameras
  - 4 microphones
  - Position sensors
    - Motor
    - Joint
  - Inertial sensors
  - Pressure sensors (feet)
  - Tactile sensor (head)
  - 3D sensor (option)



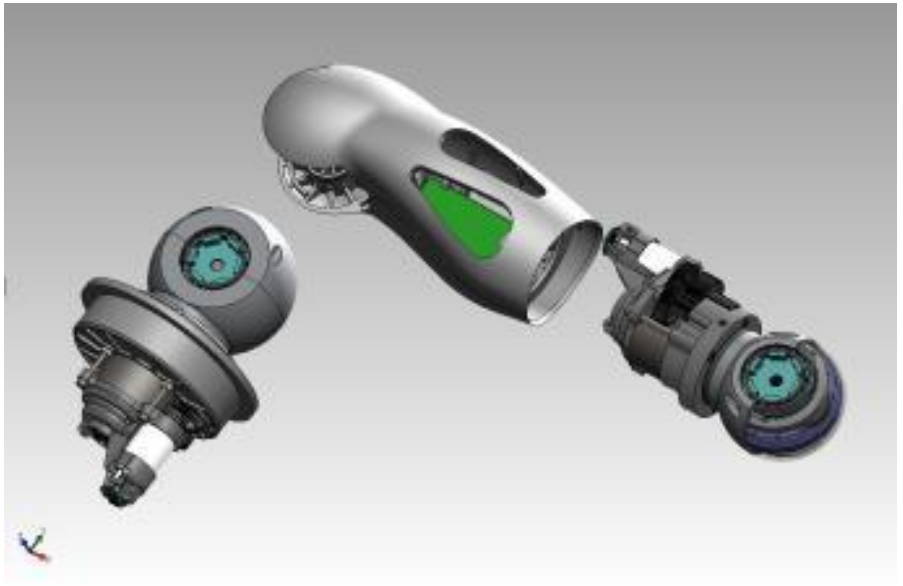
Leg

- Actuation based of cable and screw
- Differential joints in hip and ankle
- Centrod gear in the knee
- Composite Exoskeleton structure
- Flexible foot



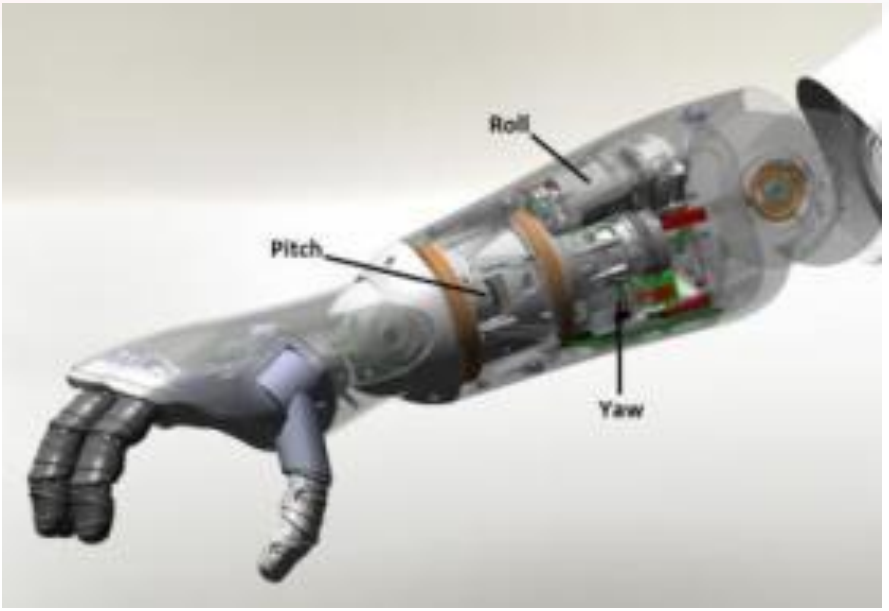
Elbow and Shoulder

- **Modules**
  - Cylinder-spherical module
  - One version for elbow and neck
  - One version for shoulder
  - Integration of the control boards



Fore Arm

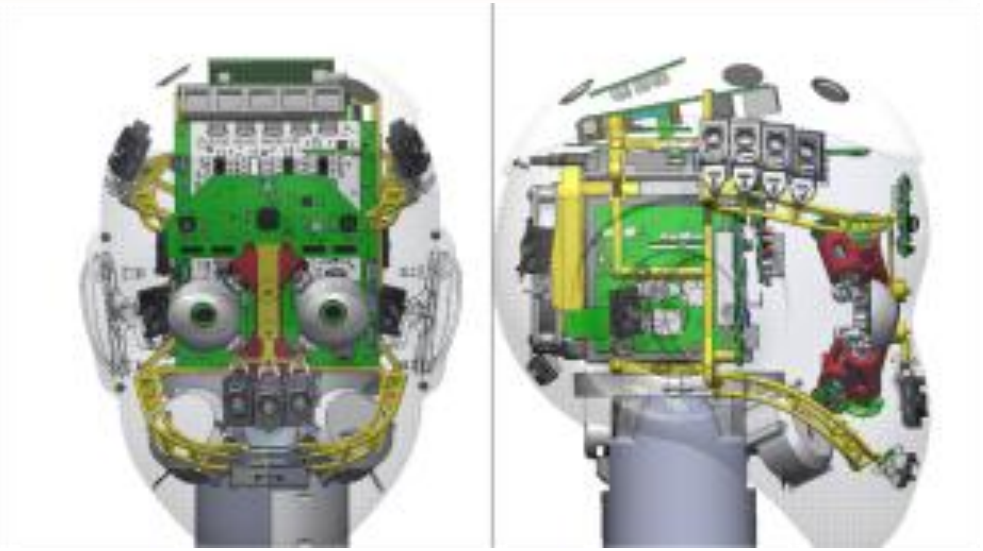
- **Wrist**
  - 3 dof
  - Spherical joint (pitch)
  - Cylinder joint (roll)
  - Actuation by wire (yaw)



- **Hand**
  - 3 fingers
  - 1 opposable thumb
  - 1 actuator

Head

- **Equipment**
  - 16 micros
  - 2 loud speakers
  - 4 cameras
  - 2 mobile eyes
  - Mouth with LEDS
  - 3 ATOM boards
  - Tactile sensor
  - Ethernet switch



- **New external design**

- **New internal design**
  - Easier assembly
  - Better robustness

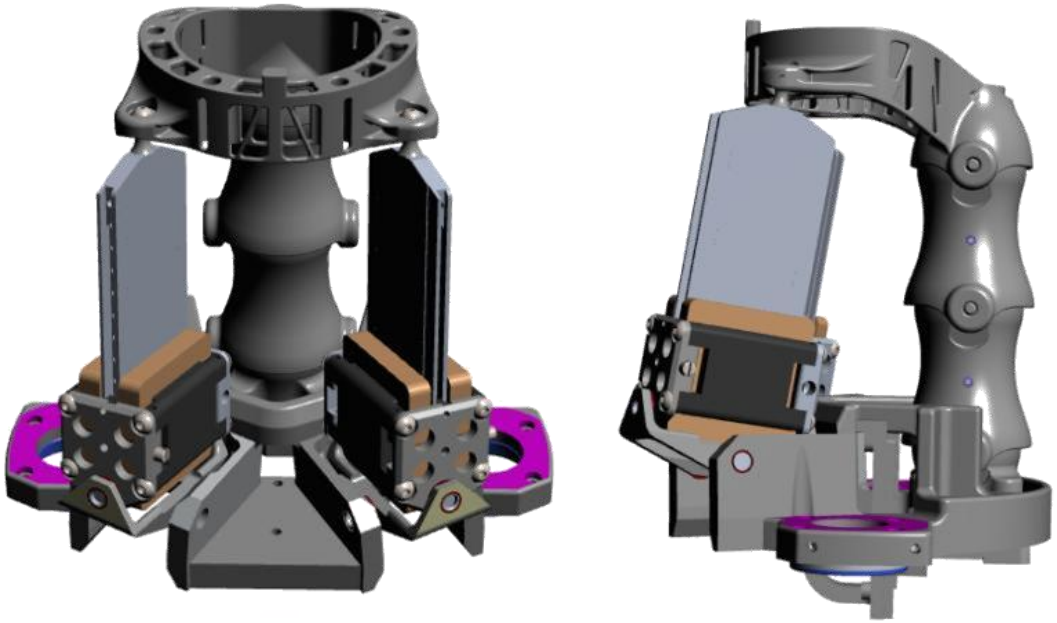
The Torso

- **Structural framework**
  - The neck in mounted in it
  - The arms are fixed on it
  - The column is fixed on it
  - The batteries are fixed on it
- **Problem**
  - Difficult assembly
  - Huge rigid piece
  - The implementation of the arms are not relevant
- **Solution**
  - New lattice structure
  - More room for the integration

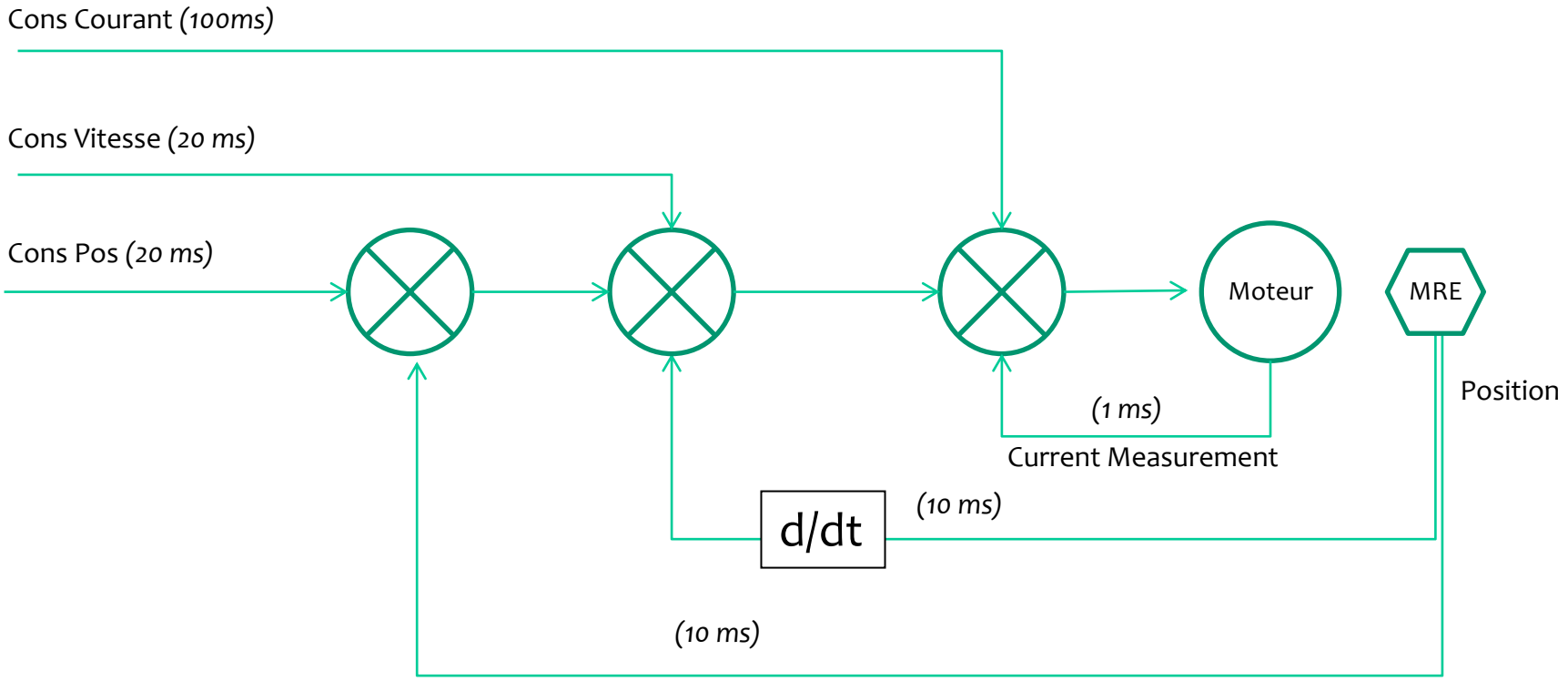
The vertebral column

- **General principle**
  - 3 vertebras with 2 DOF à deux DDL (pitch and roll)
  - The yaw joint is localized on the upper vertebra

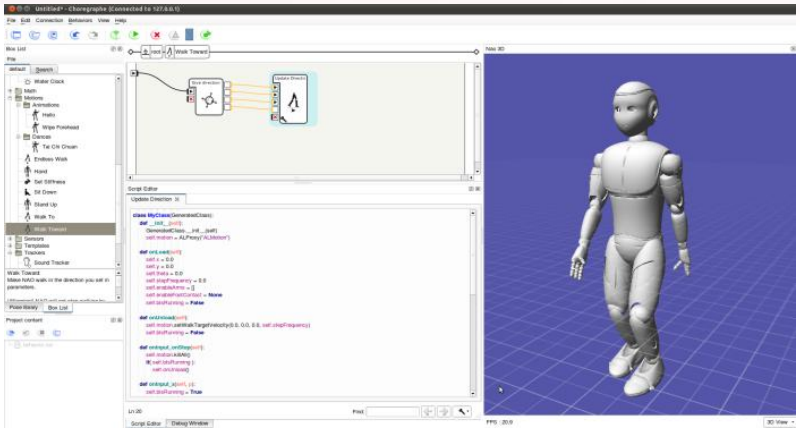
- **Actuated by electrical jacks**



Joint control



First motions of Romeo



- In Choregraphe

- In Webots

- In the real life

Man Robot Interaction

Next steps

- Romeo walks for real in December
- Romeo is delivered to Vienna University in February 2013
- 4 Romeo are delivered to 4 French research labs in June
- Research on Romeo is going on
  - Funding
    - French project Romeo 2 (18 partners, 27 M€, 4 years)
    - European project RoboHow
  - New hand, new arms
  - Mobile manipulation, vision based control,…
  - Safety
  - Evaluation

Thank you

- http://www.projetromeo.com/romeo-documentation/index.html
- http://ros.org/wiki/romeo