NOMADA

Social Robot Platform. Characteristic, structure and services to end user.

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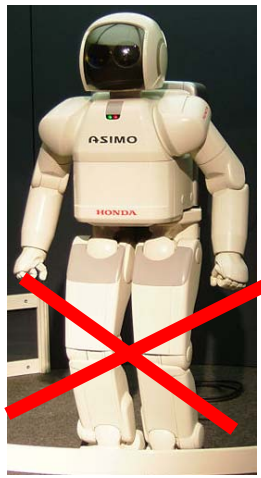
Summary

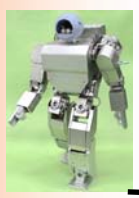
- Robot description diagram.
- Platform Structure.
  - Mechanic Structure.
  - Platform movement.
  - Sensors.
- Arms structure.
  - Mechanic Structure.
  - Arms movement.
- Auxiliary Sensors/Actuators
- Communications.
- Security errors.
- Conclusion and future works.

Introduction (I)



Humanoid Robot:
Honda ASIMO,
Extremely complex control

Miniature Robots:
Fujitsu HOAP



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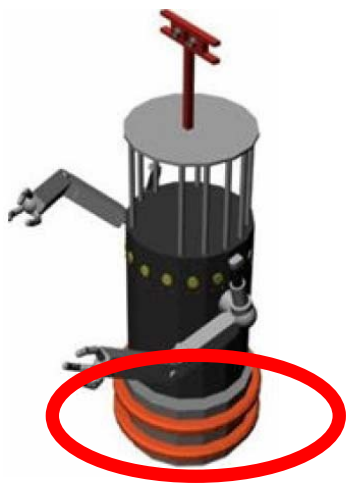
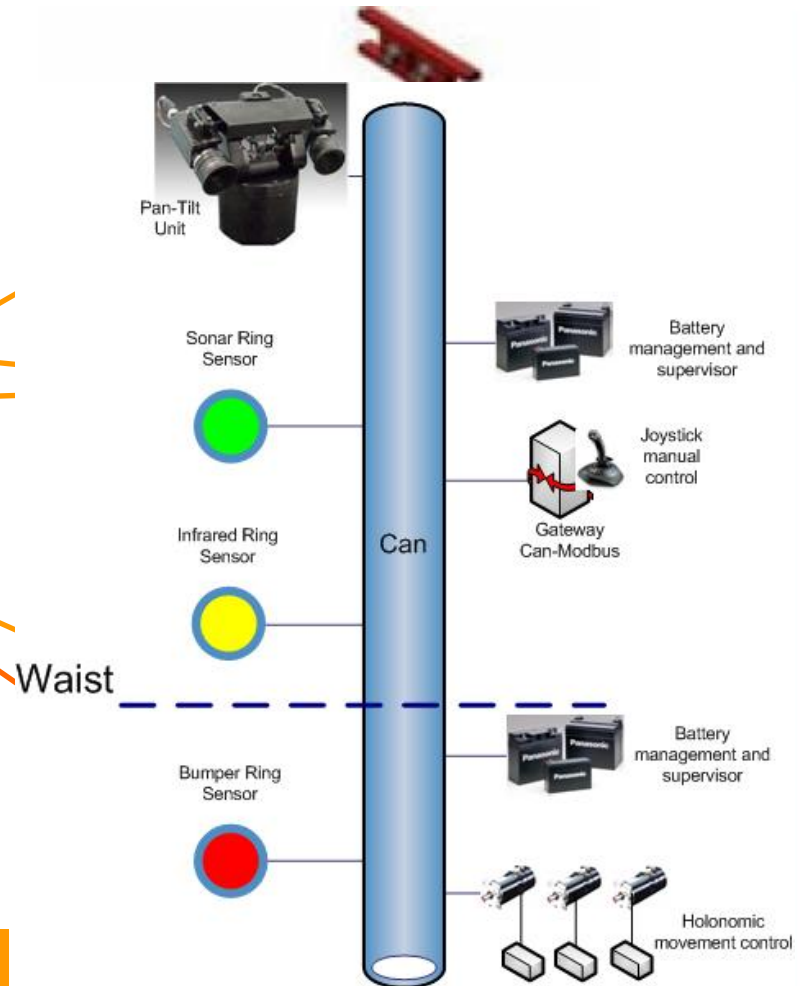


Introduction (II)

- Platform.
- Arms.
- Auxiliary Sensors to platform.



Introduction (III)

- Add modern sensors and actuator.
- Add security mechanism to prevent fails and cooperate whit people.
- Scalable power computing to use as autonomous robot.
- Use standard and easy communication to facilitate work to end user.

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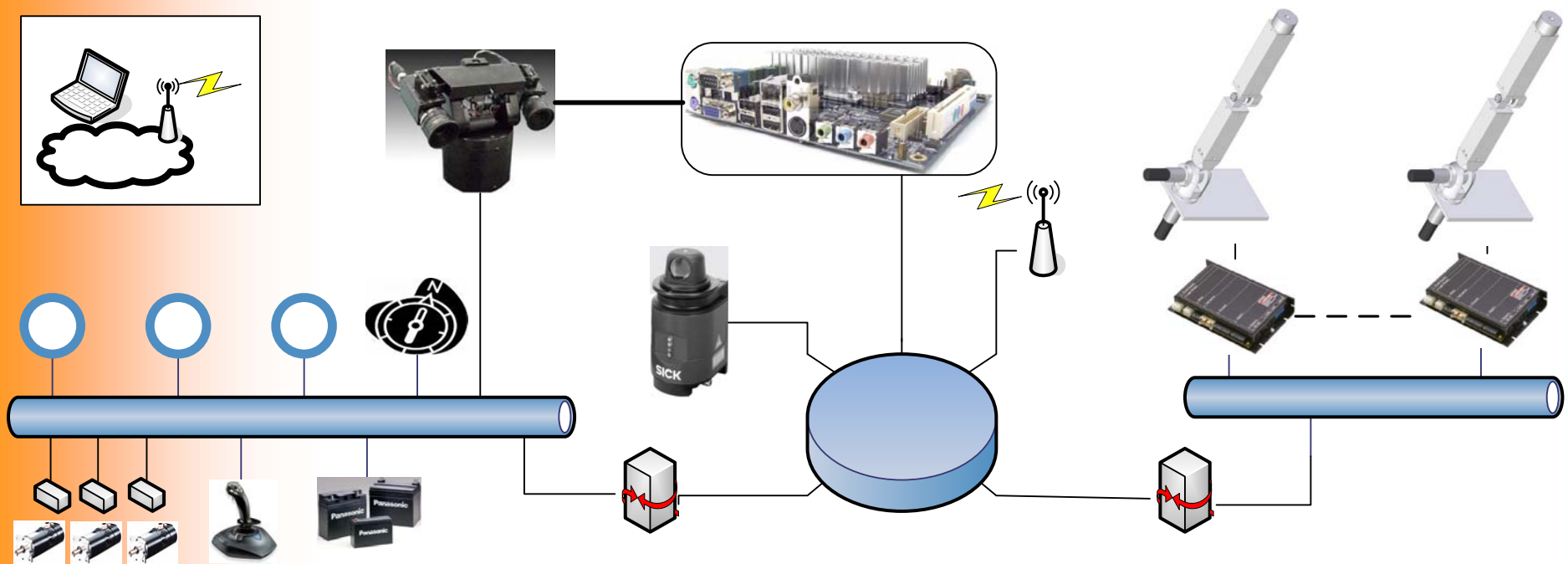
Robot description diagram



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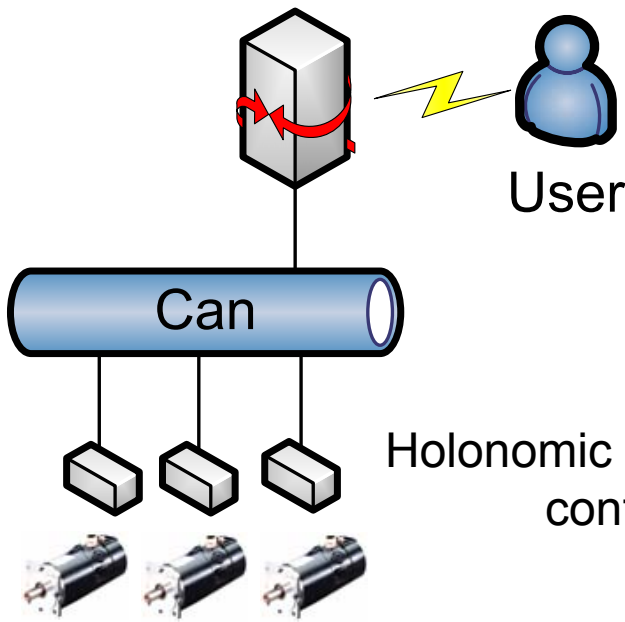
Platform structure

- Platform structure have 3 DOF.
- Same HW controller for 3 DOF.
- HW controller implementing:
  - PID position-based
  - PID velocity-based
  - Modified Moving Average for position-based control.
  - Security and monitoring options.
- Gateway/Coordinator:
  - Offers user easy connection.
  - Coordinates 3 DOF to reconstruct odometry and to set command to movement in high level.

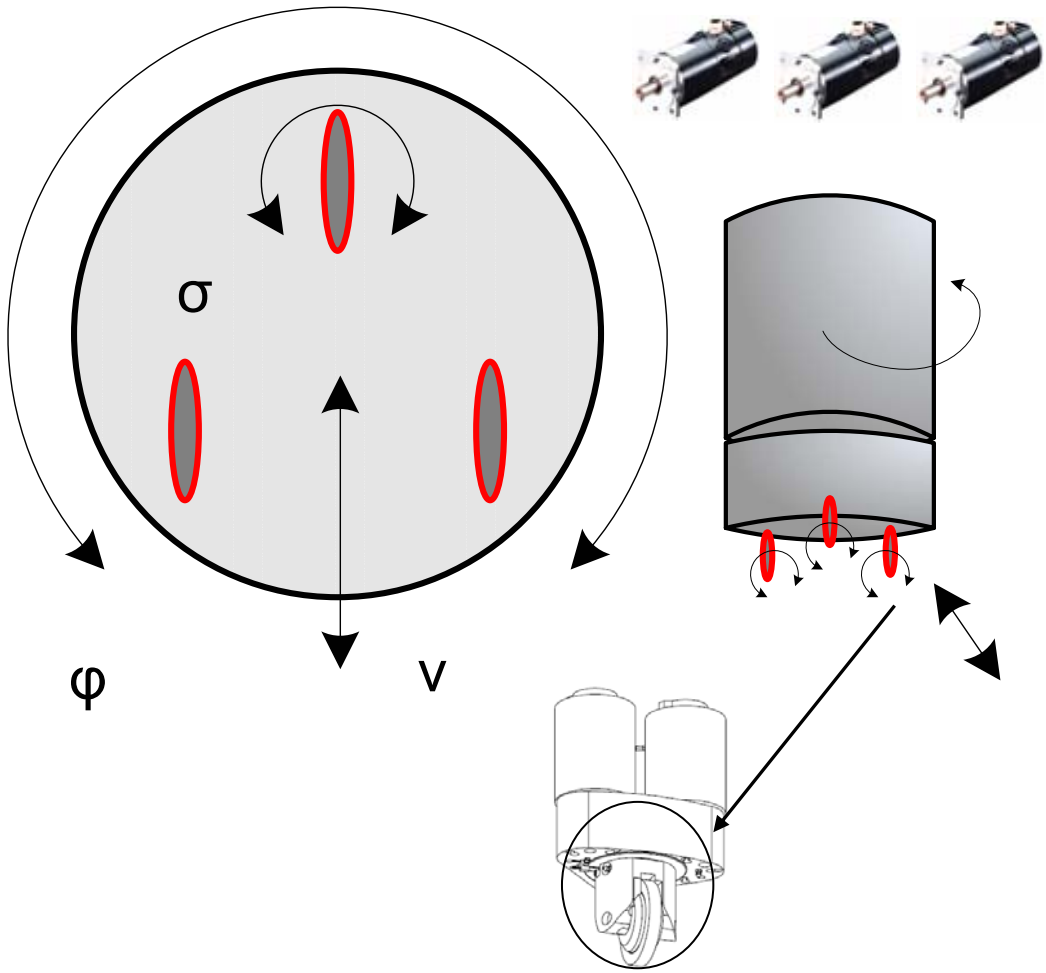


Holonomic movement control

Platform structure - Mechanic

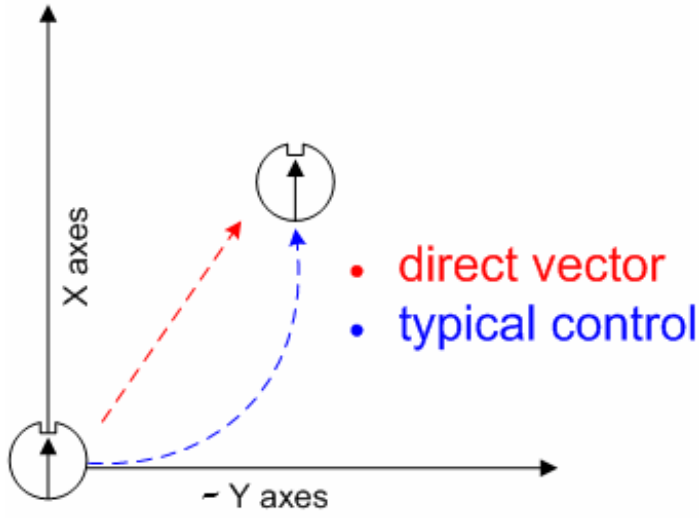
- 3 Wheels use the same advance and direction; Syncro-drive.
- 2 DOF for advance and direction.

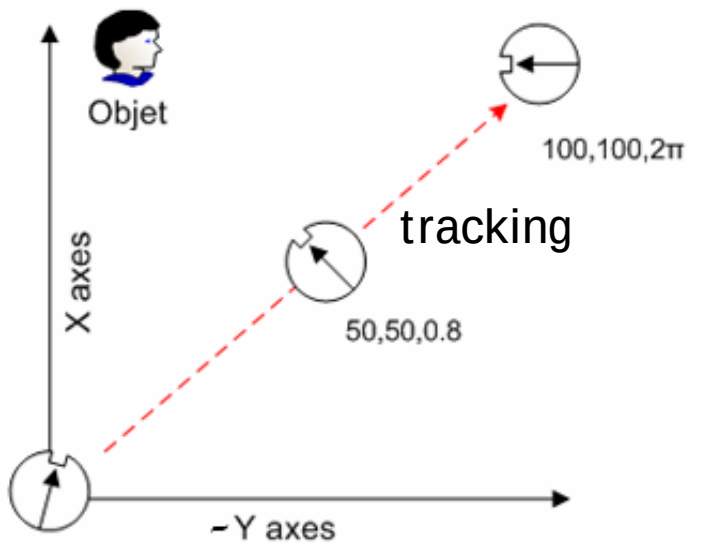
  Same advance and direction => same orientation.
- 1 DOF for waist; change Robot orientation. (Only upper side)



Platform structure - Movement

- Platform Robot offer to user:
  - Odometry: X(mm),Y(mm), φ (mrad)
  - Set points, two method:
    - v(mm/s), θ(mrad), φ (mrad) → direct vector
    - sv, ω(mrad/s), σ (mrad/s) → typical control
  - Real point: v, θ, φ
  - Real velocity 3 DOF: v_1 / v_2 / v_3
- It´s possible to track object for **fixed** visual systems and others sensor.





Platform structure - Sensors

- Sensors:
  - Bumper Ring (20 units). O
    - On/Off
  - Infrared Ring (16 units). O
    - 50 - 100 mm
  - Sonar Ring (16 units). O
    - 0.5 - 10 m
  - Industrial heading sensor (Compass)
  - Battery supervisor.
- Security sensor are configurable to stop robot in possible collision.
- Security system are configurable to power down system to prevent fails.

KVH-C100 Compass

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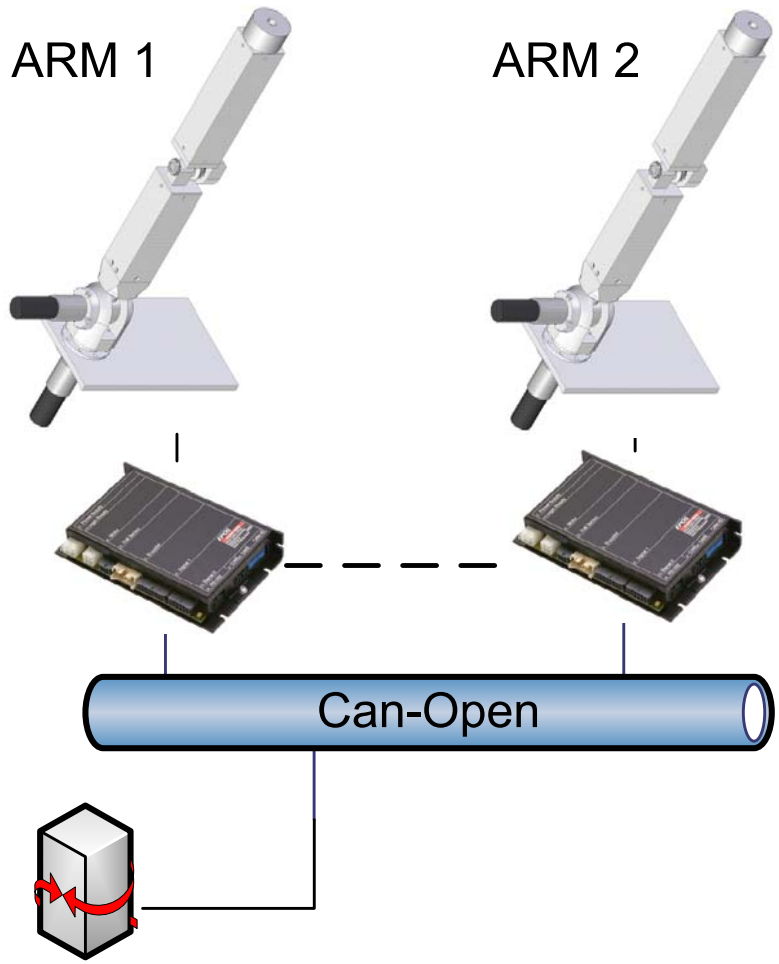
Arms structure

- Full custom design.
- Two Arms, 4 DOF each one
- High quality commercial controller and motors.
- Easy communication to end user.
- Space movement similar to human.
- Incremental encoders, it´s necessary manual initialize.



Arms structure - Sample

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Auxiliary Sensors/Actuators

- Distance measurement using Laser 360º/80m (SICK LD OEM1000).
- Pan,Tilt, Vergence Head with ethernet conexion.
- Stereo vision System 1394 and library offer by manufacturer (Videre Design STH-DCSG-VAR, windows and Linux support).
- Other:
  - Scalable computer based on mini-itx
    Kontron 986LCD-M/mITX
    (Intel Core2 Duo 4M L2 2G@667)

986LCD-M/mITX BGA

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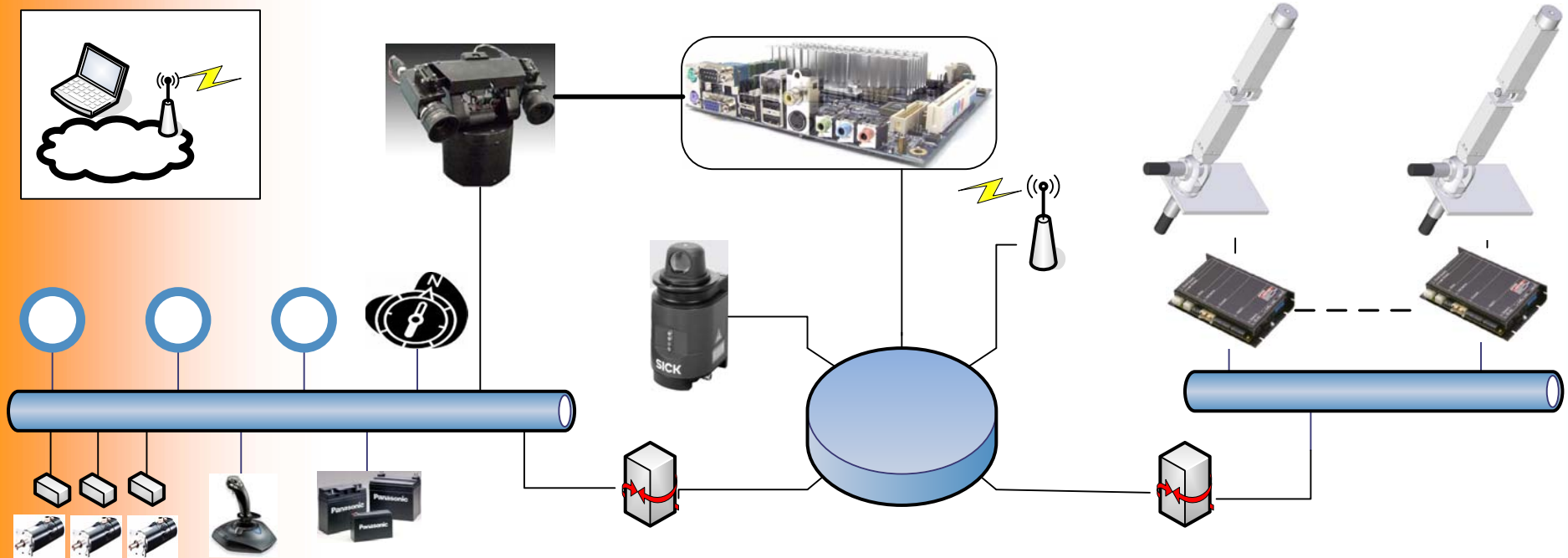
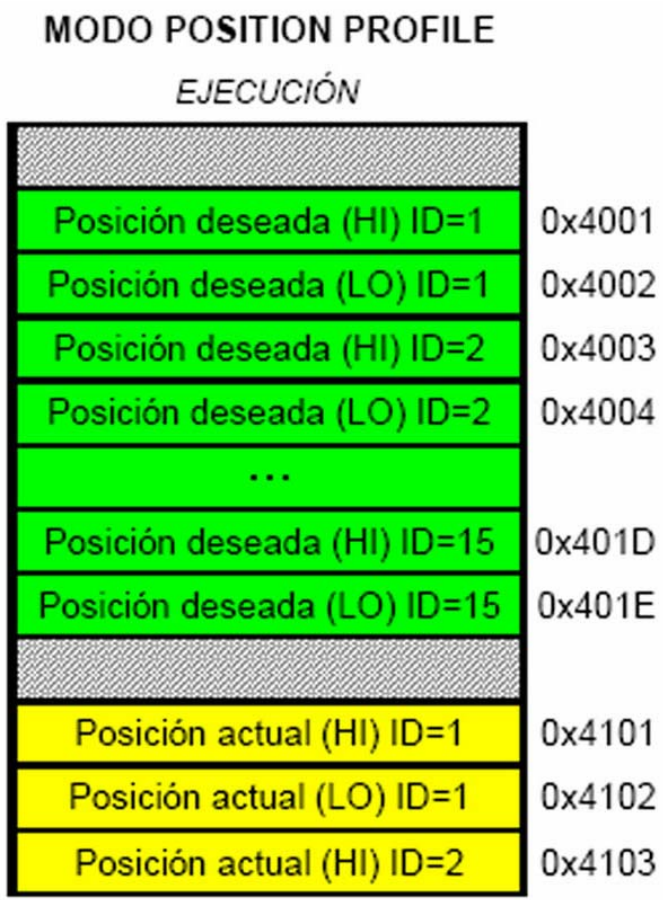
Communications (I)



Communications (II)

- MODBUS register mapping example
- 16 bits registers
- In one request you could read or write various adjacent registers



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Security errors

Types of error:

- Collision detected by bumper.
- Obstacle detected by Infrared system.
- Obstacle detected by sonar ring.
- Malfunction in controllers or other subsystems.
- Low Battery and fails in power management.

Alarms:

- Event oriented alarm messages in CAN
- Hardware established priority
- Alarms are software enable

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Conclusion and future works

- CONCLUSIONS
  - Robust design
  - Versatile platform for social applications and environment interaction
  - Excellent odometry reconstruction
  - Easily reparable system due to full-custom design

- FUTURE WORKS
  - Redesign arms to resize them
  - Fully integration and mount of all subsystems and sensors
  - Develop full robot demo software
  - Develop maintain and test software

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