Robots Moviles

UNIDAD 2: Fundamentos y Morfología

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U2: Fundamentos y morfologia

Estructura: HW and SW interacción

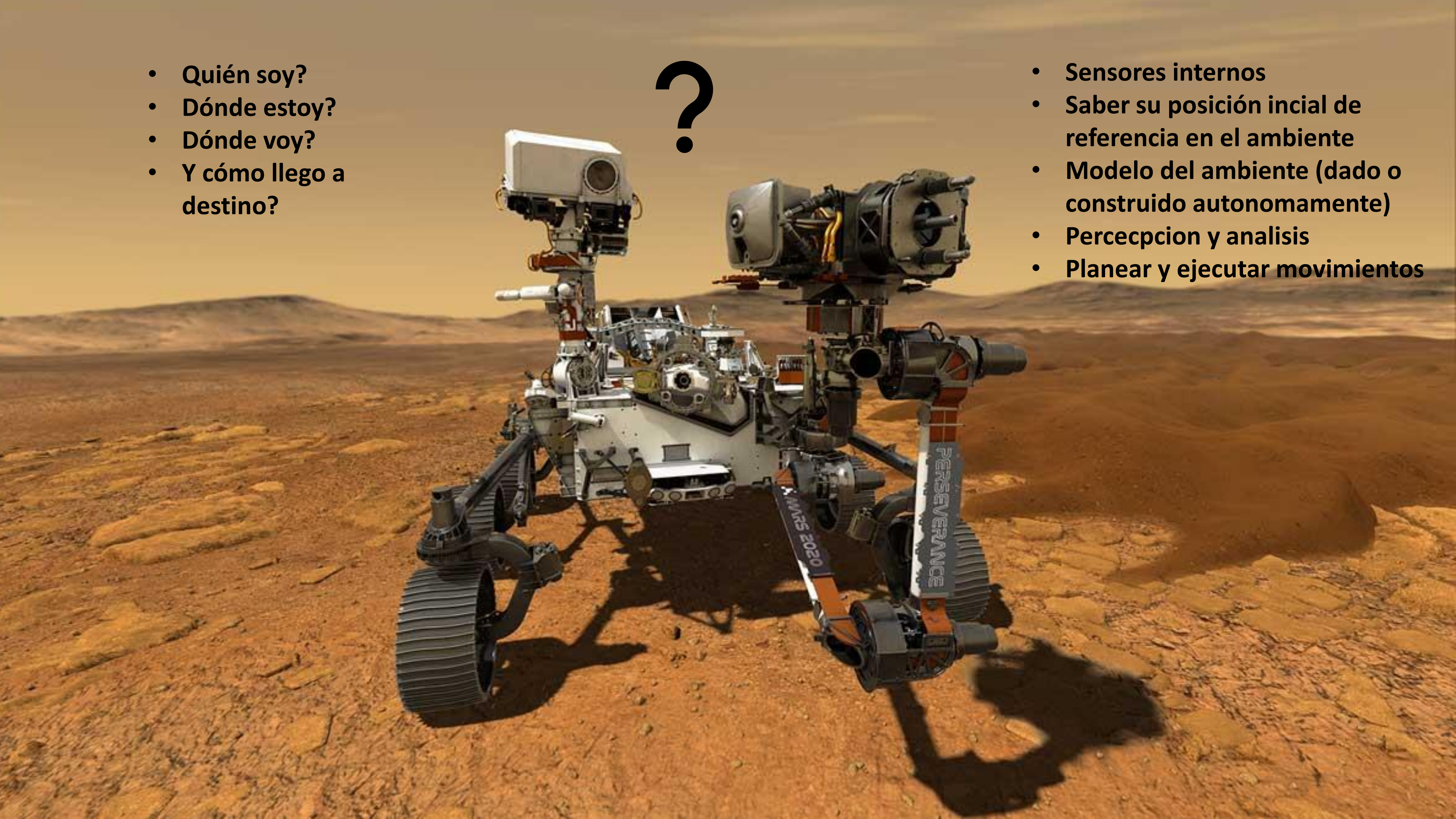
Tipos de Locomoción

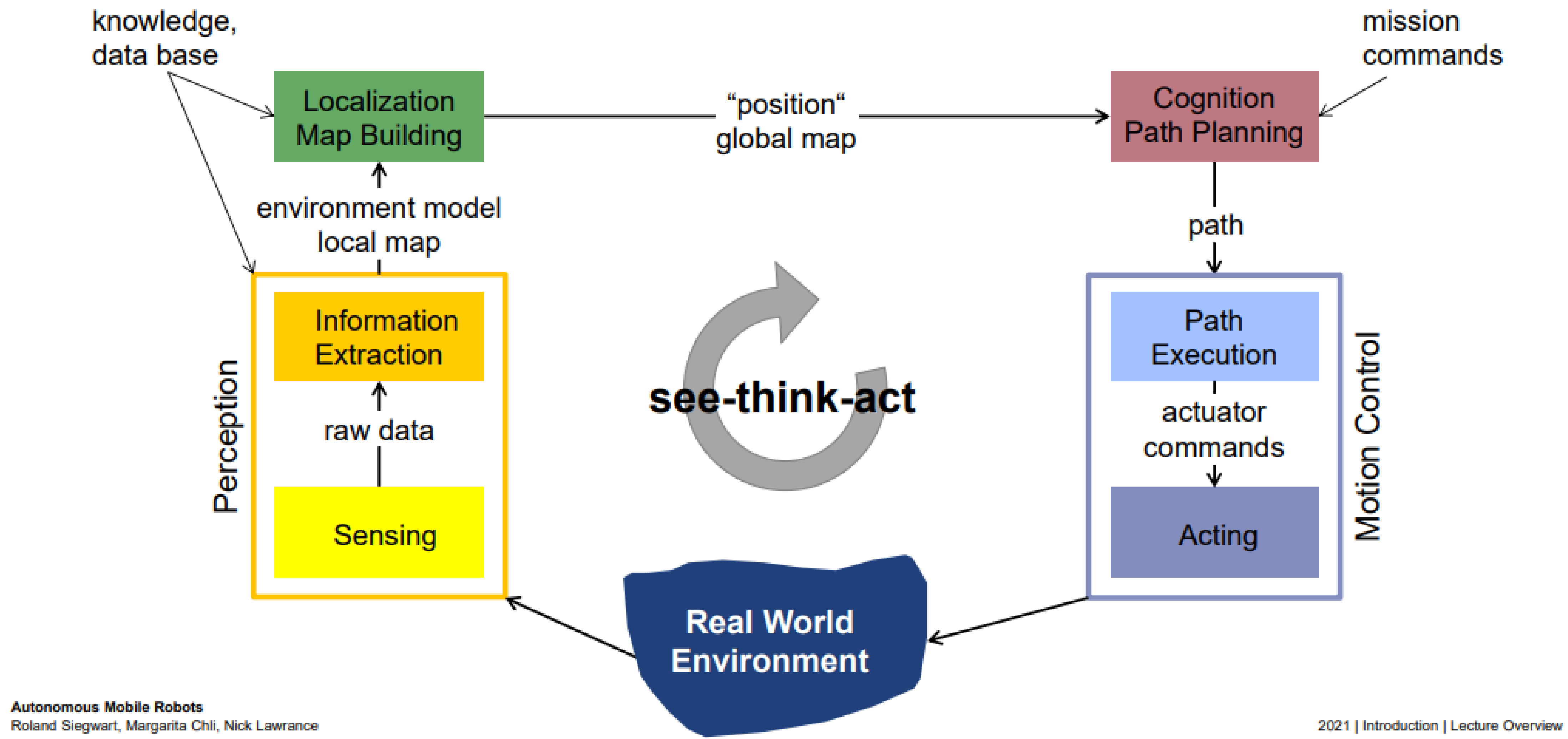
Manipulabilidad

- Quién soy?
- Dónde estoy?
- Dónde voy?
- Y cómo llego a destino?

?

- Sensores internos
- Saber su posición incial de referencia en el ambiente
- Modelo del ambiente (dado o construido autonomamente)
- Percecpcion y analisis
- Planear y ejecutar movimientos





Esquema genérico de control RM - [1 - Autonomous Mobile Robots – R. Siegwart *et all*]

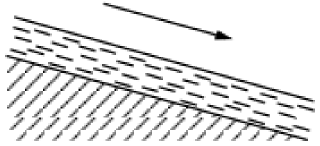
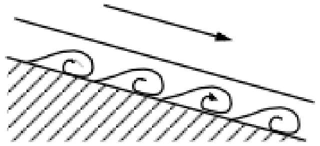
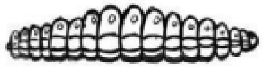
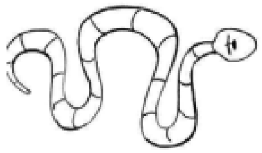
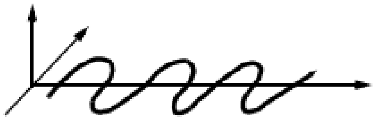
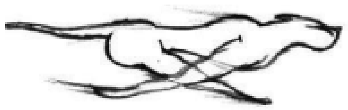
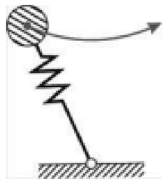
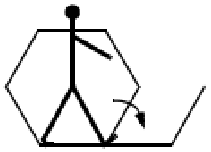
Locomoción y Manipulación

Características importantes a tener en cuenta cuando hablamos de locomoción y manipulación [1]:

- estabilidad
  - número y geometría de los puntos de contacto.
  - centro de gravedad
  - dinámica
  - Inclinación del terreno

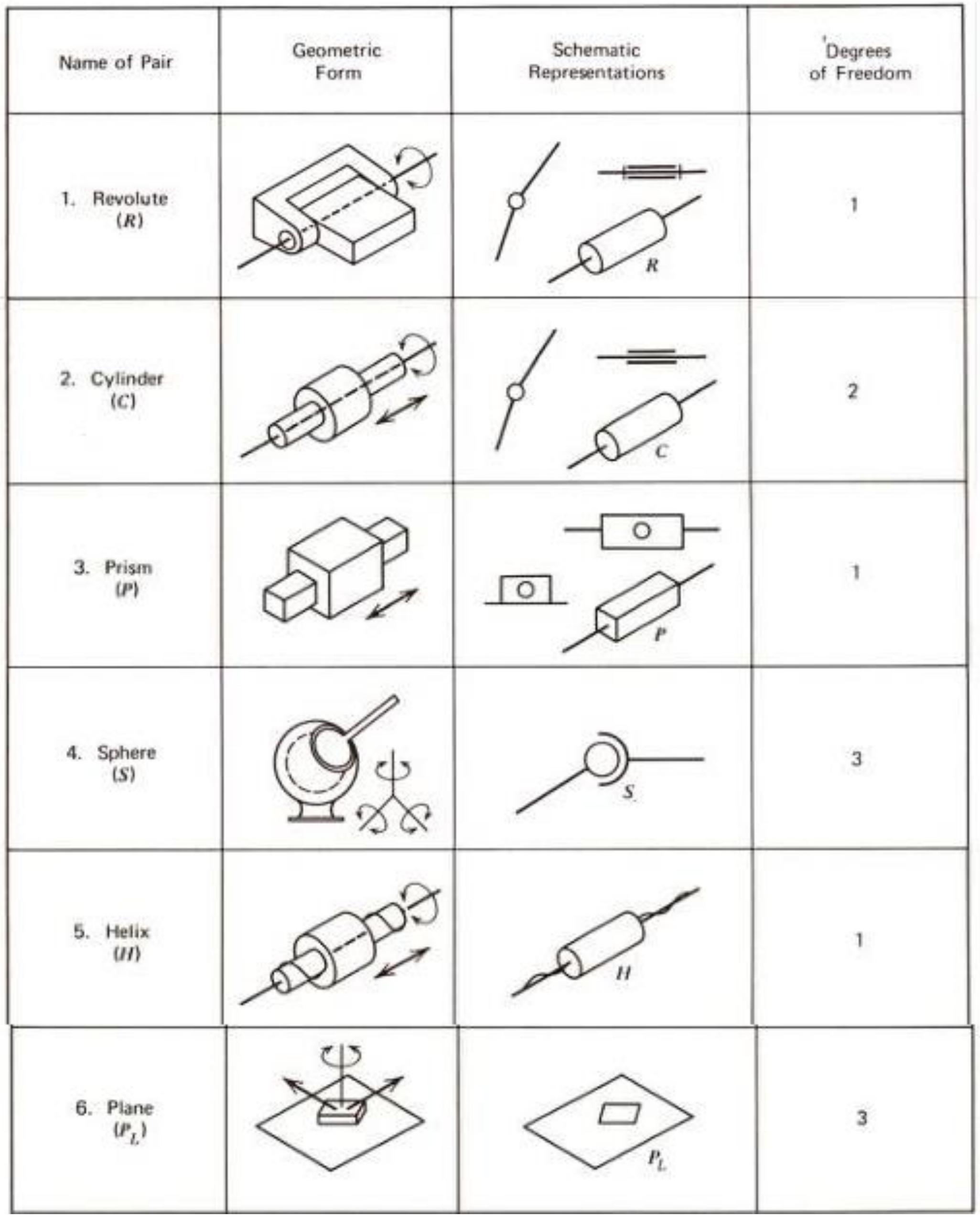
- Características del contacto
  - Punto de contato: tamaño/forma
  - Angulo de contacto
  - Fricción

- Tipo de ambiente
  - Estructura
  - Medio(agua, tierra, aire, tipo de superficie)
  - Ambiente (temp, espacio)

Type of motion		Resistance to motion	Basic kinematics of motion	
Flow in a Channel		Hydrodynamic forces	Eddies	
Crawl		Friction forces	Longitudinal vibration	
Sliding		Friction forces	Transverse vibration	
Running		Loss of kinetic energy	Periodic bouncing on a spring	
Walking		Loss of kinetic energy	Rolling of a polygon (see figure 2.2)	

Mecanismos de locomoción
[1 - Autonomous Mobile Robots – R. Siegwart *et all*

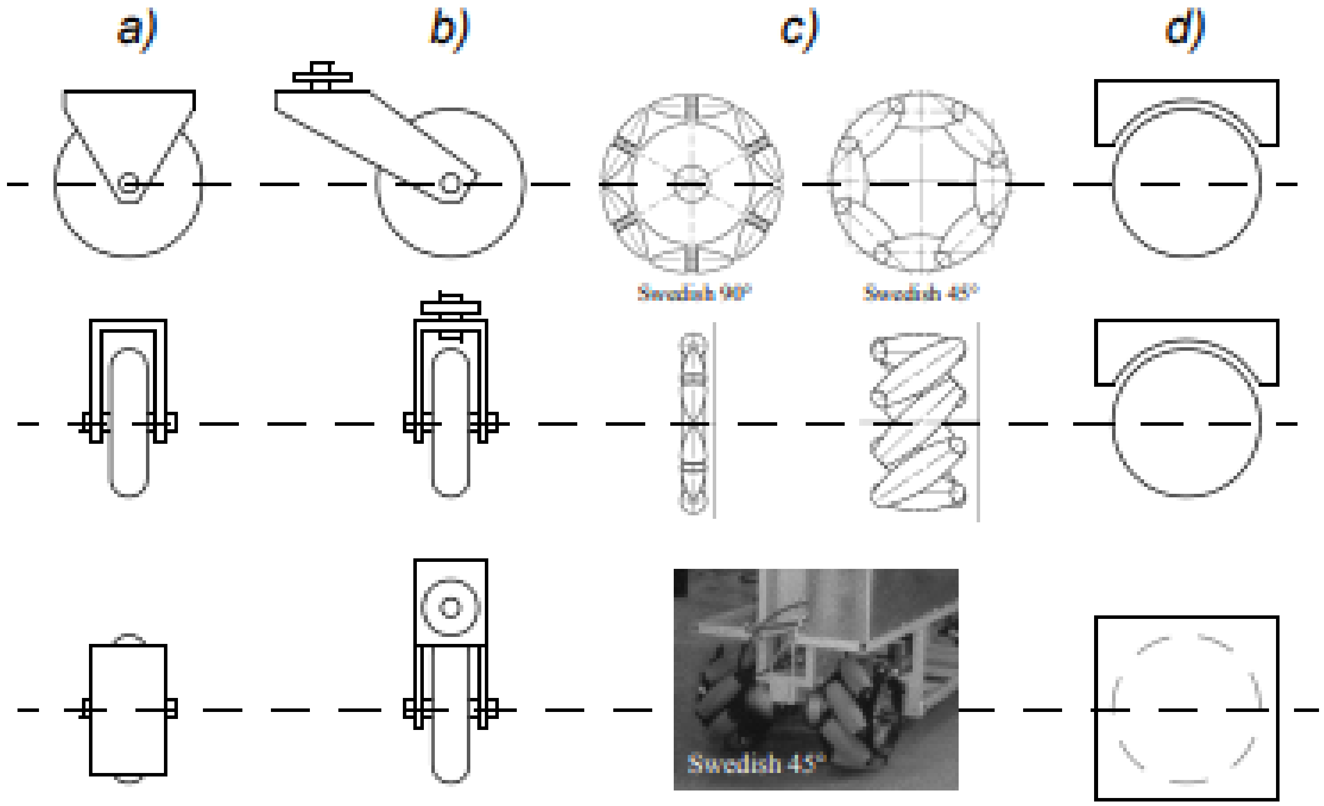
DOF Robot vs Espacio 3D



Name of Pair	Geometric Form	Schematic Representations	Degrees of Freedom
1. Revolute (*R*)		*R*	1
2. Cylinder (*C*)		*C*	2
3. Prism (*P*)		*P*	1
4. Sphere (*S*)		*S*	3
5. Helix (*H*)		*H*	1
6. Plane (P_L)		P_L	3

Specifications: Weight: 7 kg Height: 58 cm Neck DOF: 4 Body DOF: 2 Arm DOF: 2 5 Legs DOF: 2 6 Five-finger Hands

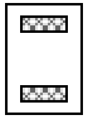
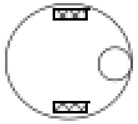
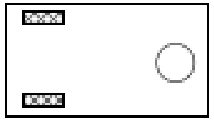
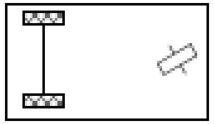
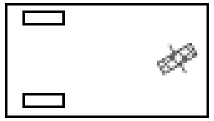
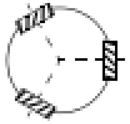
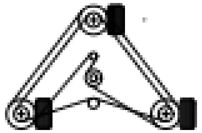
Mobile Robot



Problemas:
(según tipo de terreno, entorno, obstaculos)

- Tracción
- Estabilidad
- Maniobrabilidad
- Control

Mobile Robot

# of wheels	Arrangement	Description	Typical examples
2		One steering wheel in the front, one traction wheel in the rear	Bicycle, motorcycle
		Two-wheel differential drive with the center of mass (COM) below the axle	Cye personal robot
3		Two-wheel centered differential drive with a third point of contact	Nomad Scout, smartRob EPFL
		Two independently driven wheels in the rear/front, one unpowered omnidirectional wheel in the front/rear	Many indoor robots, including the EPFL robots Pygmalion and Alice
		Two connected traction wheels (differential) in rear, one steered free wheel in front	Piaggio minitrucks
		Two free wheels in rear, one steered traction wheel in front	Neptune (Carnegie Mellon University), Hero-1
		Three motorized Swedish or spherical wheels arranged in a triangle; omnidirectional movement is possible	Stanford wheel Tribolo EPFL, Palm Pilot Robot Kit (CMU)
		Three synchronously motorized and steered wheels; the orientation is not controllable	"Synchro drive" Denning MRV-2, Georgia Institute of Technology, I-Robot B24, Nomad 200

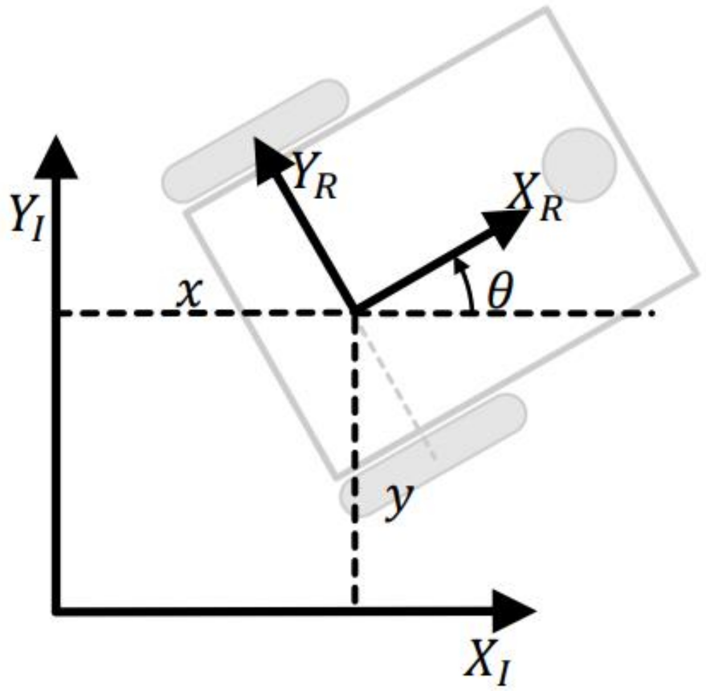
Geometria → Control de Movimiento

$$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \end{bmatrix} = f(\dot{\varphi}_1 \cdots \dot{\varphi}_n, \theta, geometry)$$

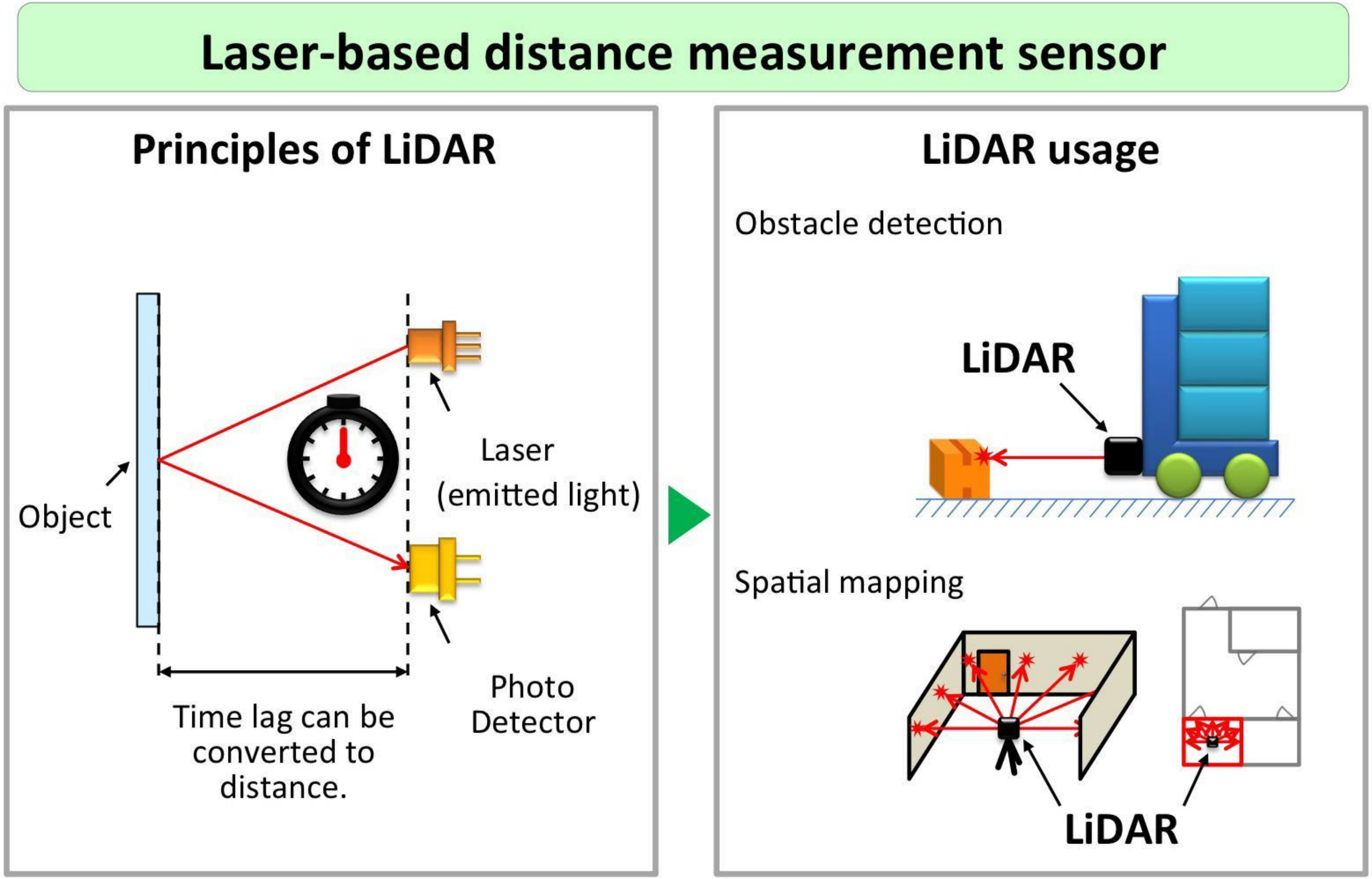
$$\begin{bmatrix} \dot{\varphi}_1 \\ \vdots \\ \dot{\varphi}_n \end{bmatrix} = f(\dot{x}, \dot{y}, \dot{\theta})$$

?

Autonomous Mobile Robots
Roland Siegwart, Margarita Chli, Nick Lawrance

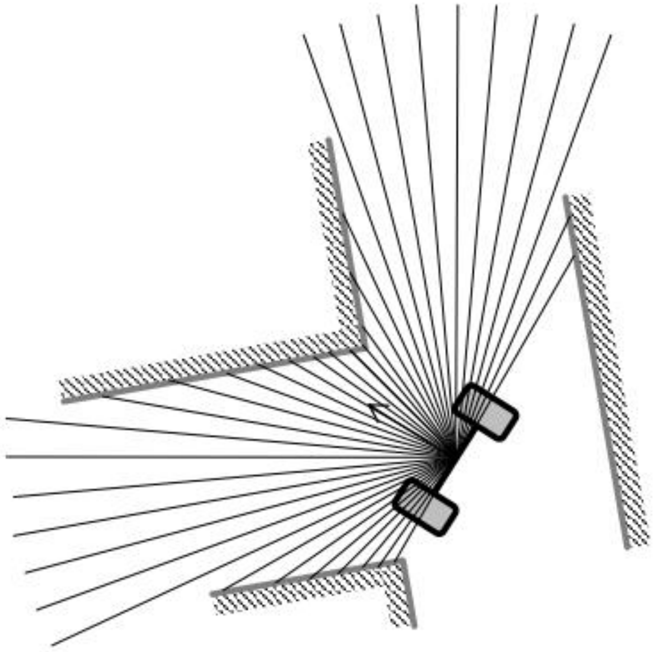


Sensores: laser/lidar

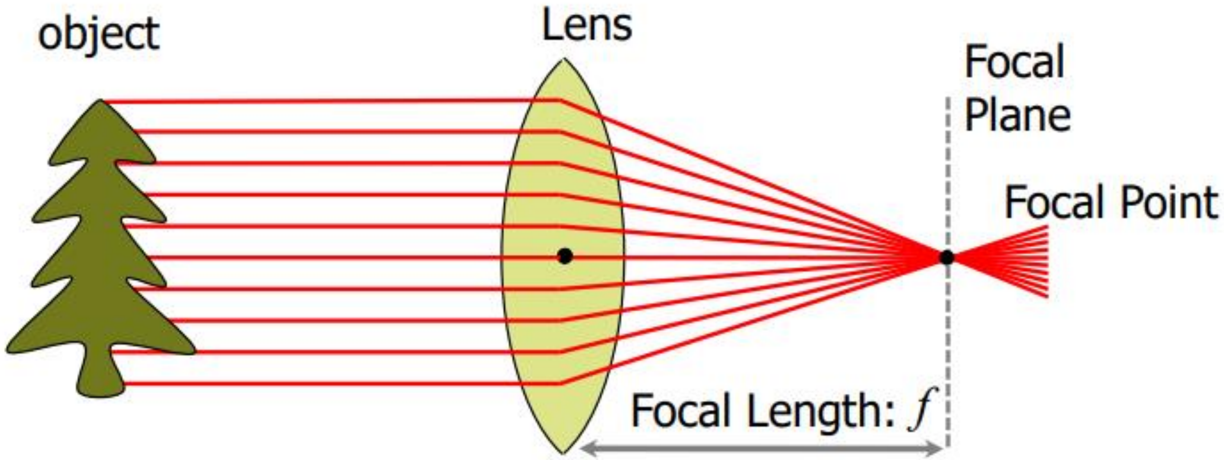


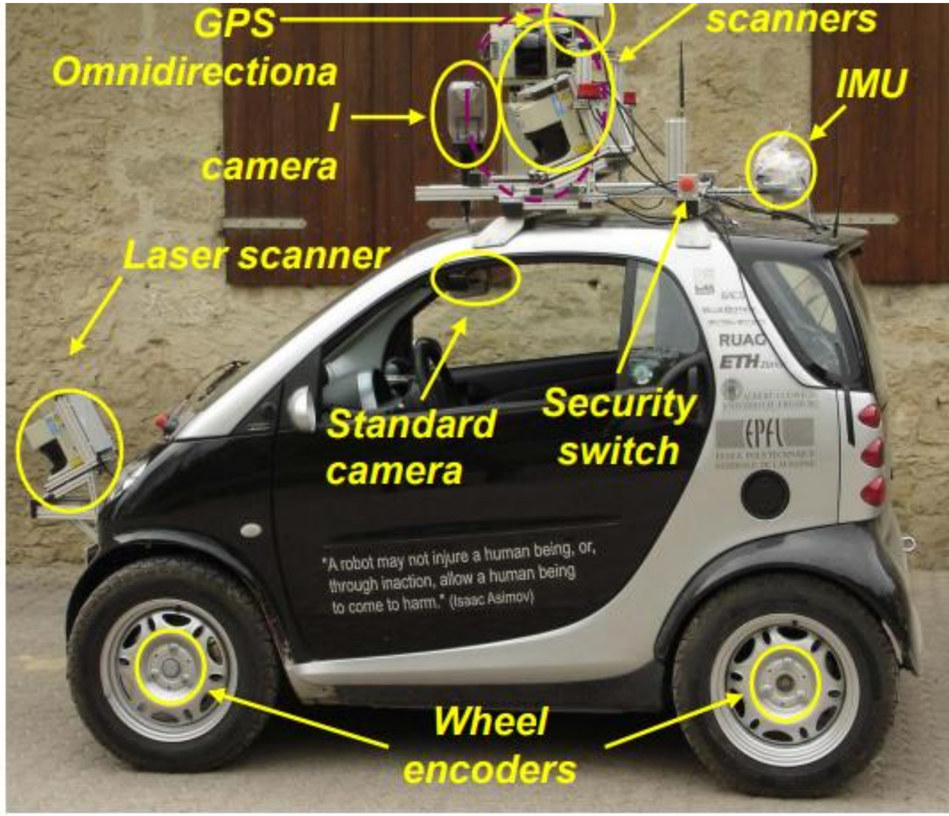
Sensores: Camara

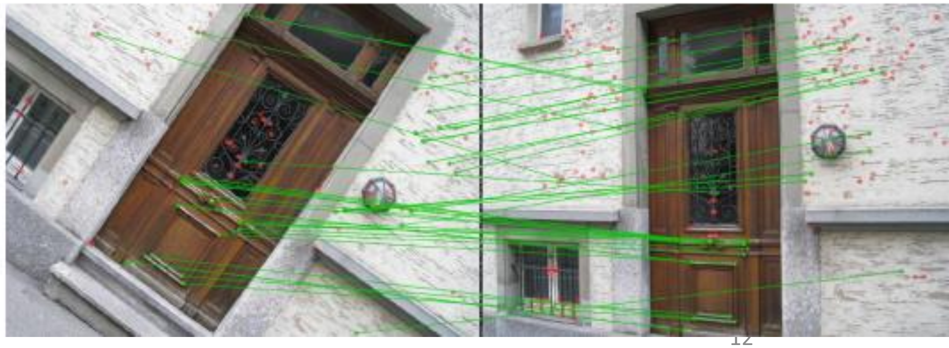
- Laser scanner
  - time of flight



- Camera



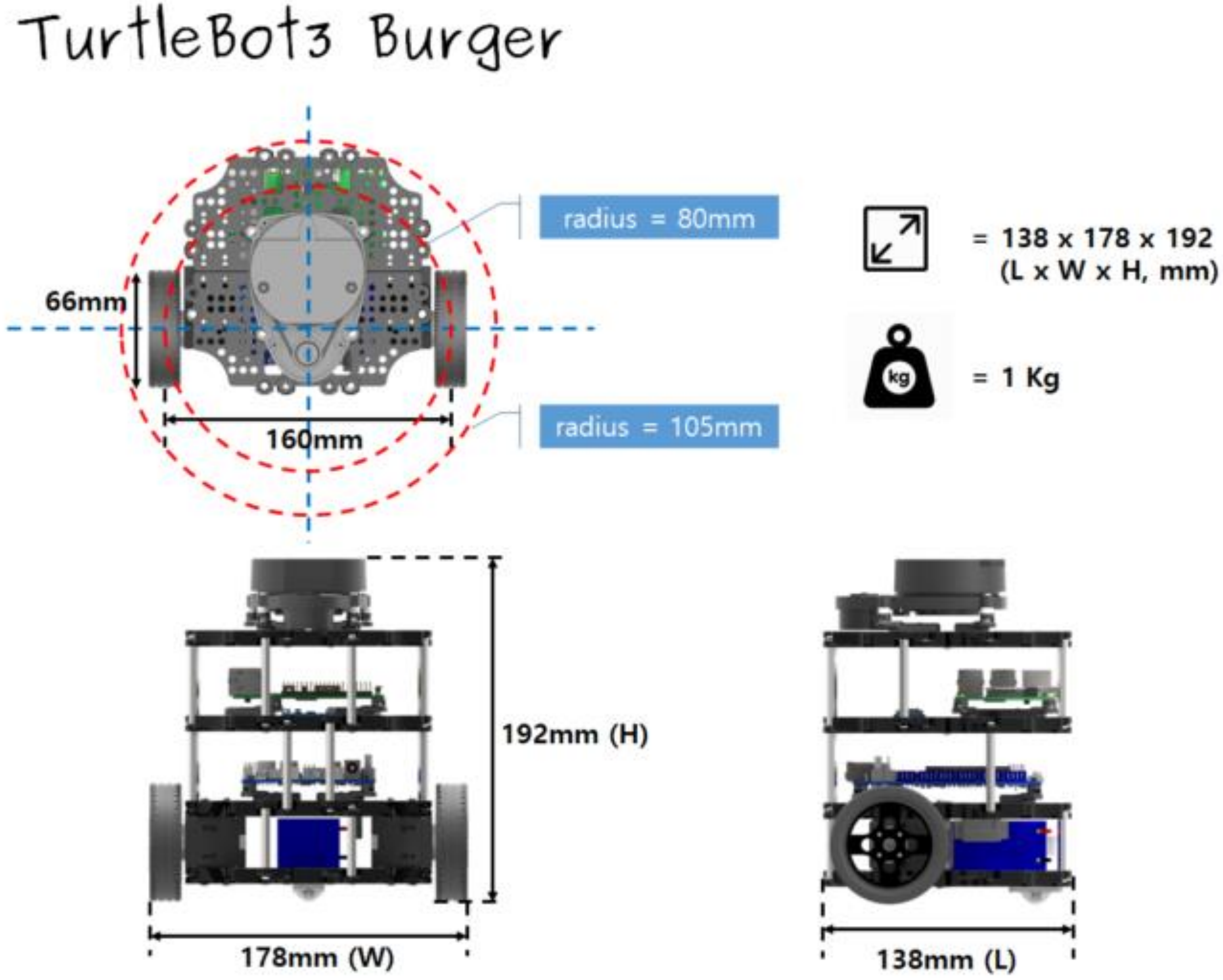




Sensors

General classification (typical use)	Sensor Sensor System	PC or EC	A or P
Tactile sensors (detection of physical contact or closeness; security switches)	Contact switches, bumpers Optical barriers Noncontact proximity sensors	EC EC EC	P A A
Wheel/motor sensors (wheel/motor speed and position)	Brush encoders Potentiometers Synchros, resolvers Optical encoders Magnetic encoders Inductive encoders Capacitive encoders	PC PC PC PC PC PC PC	P P A A A A A
Heading sensors (orientation of the robot in relation to a fixed reference frame)	Compass Gyroscopes Inclinometers	EC PC EC	P P A/P
Acceleration sensor	Accelerometer	PC	P
Ground beacons (localization in a fixed reference frame)	GPS Active optical or RF beacons Active ultrasonic beacons Reflective beacons	EC EC EC EC	A A A A
Active ranging (reflectivity, time-of-flight, and geometric triangulation)	Reflectivity sensors Ultrasonic sensor Laser rangefinder Optical triangulation (1D) Structured light (2D)	EC EC EC EC EC	A A A A A
Motion/speed sensors (speed relative to fixed or moving objects)	Doppler radar Doppler sound	EC EC	A A
Vision sensors (visual ranging, whole-image analysis, segmentation, object recognition)	CCD/CMOS camera(s) Visual ranging packages Object tracking packages	EC	P

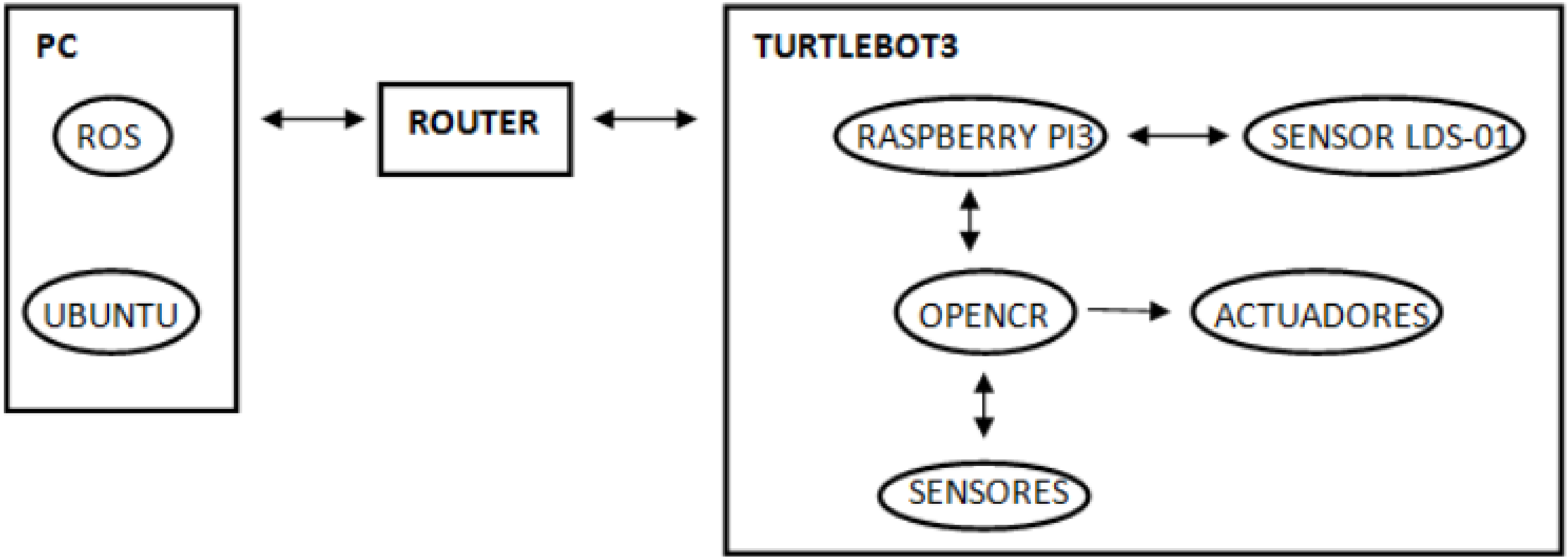
A, active; P, passive; P/A, passive/active; PC, proprioceptive; EC, exteroceptive.



https://emanual.robotis.com/docs/en/platform/t

Hardware Specifications

Esquema Arquitectura Turtlebot



Práctico 2

- Elija un robot Movil disponible en el mercado o realice su propio diseño

- Describa su geometria y caracteristicas fisicas (cant ruedas, mtores comos se accionan, etc)

- Describa senrores internos y externos

- Prepare una presentación max tres slides y tres min, defina campos de aplicación posibles.