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Computer Vision for an Autonomous Mobile Robot

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Vision systems

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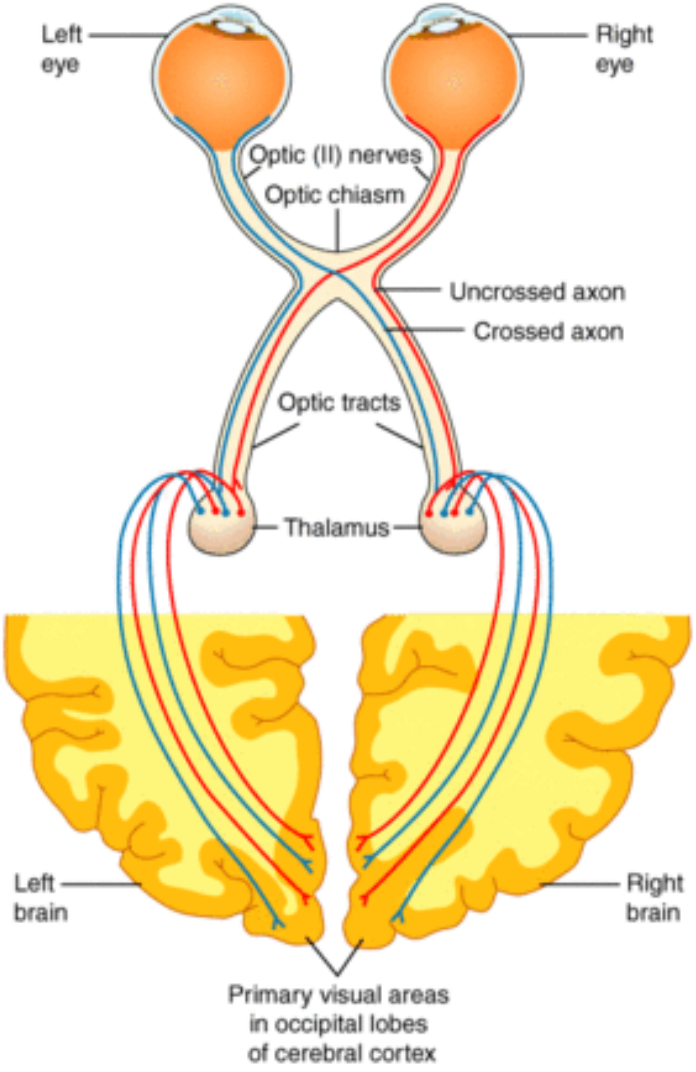
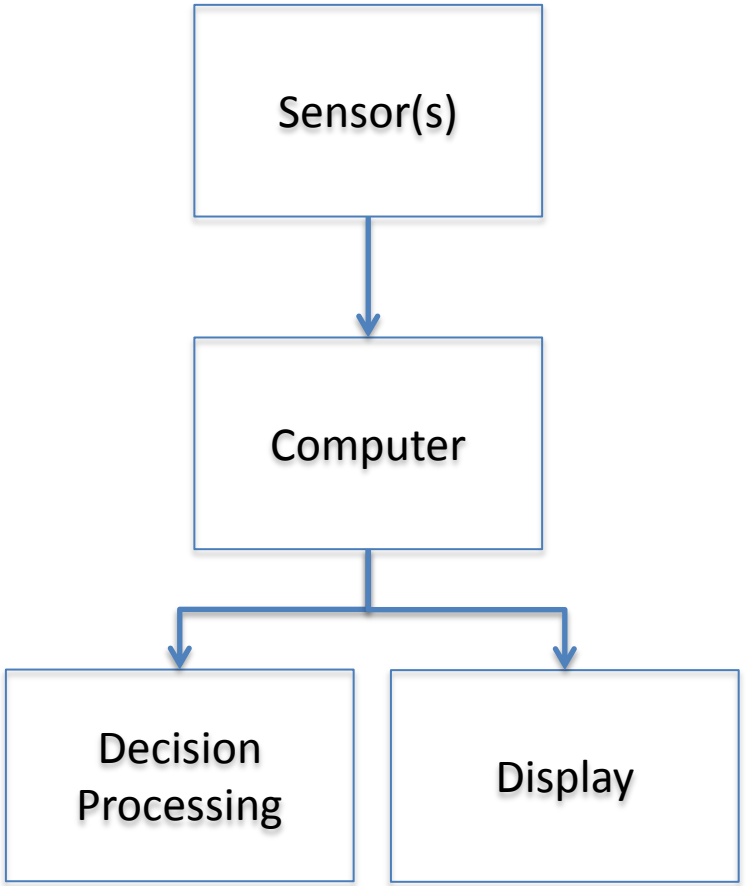
Vision systems

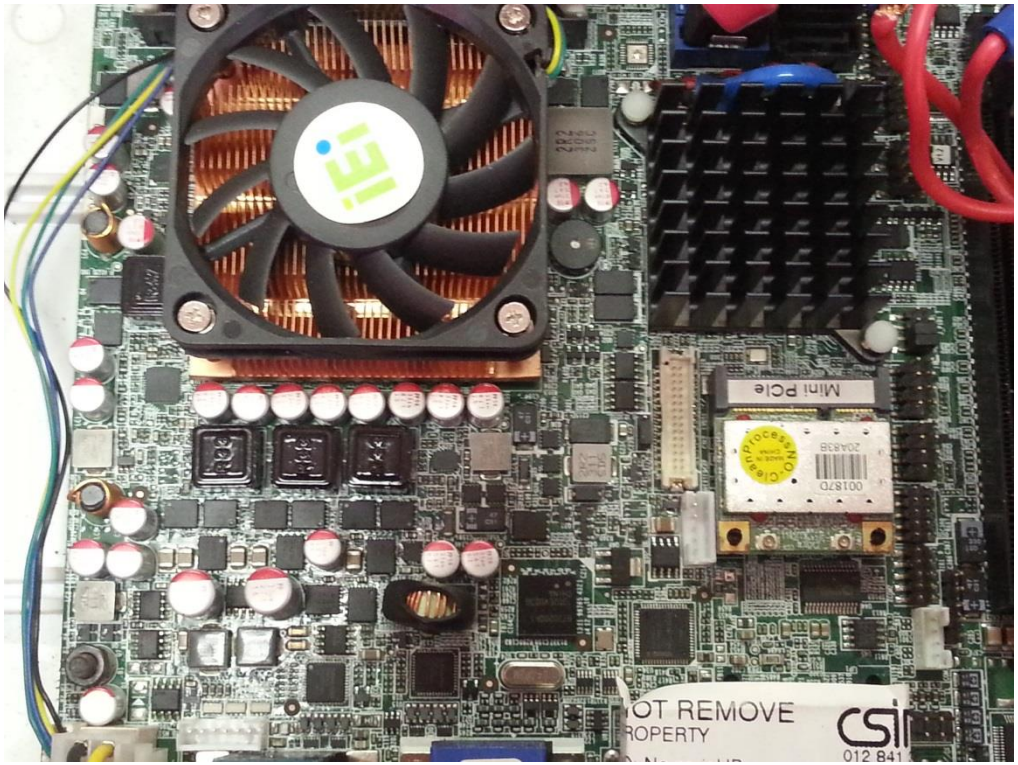


- Human vision system
  - Two primary vision sensors (eyes)
  - CNS: analysis and interpretation

Vision systems



- Computer vision system
  - One or more vision sensors
  - Computer: analysis and interpretation



Vision systems

- Common sensor types

Monocular camera

Omni-directional camera

Laser scanner

Stereo camera

Sonar array

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Computer vision for a mobile machine

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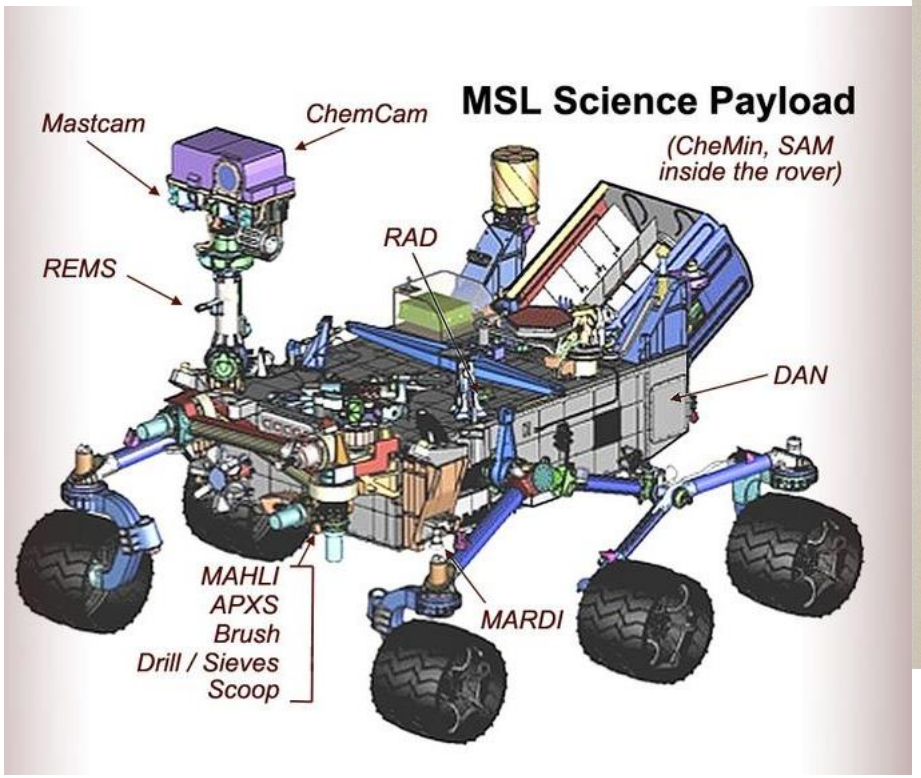
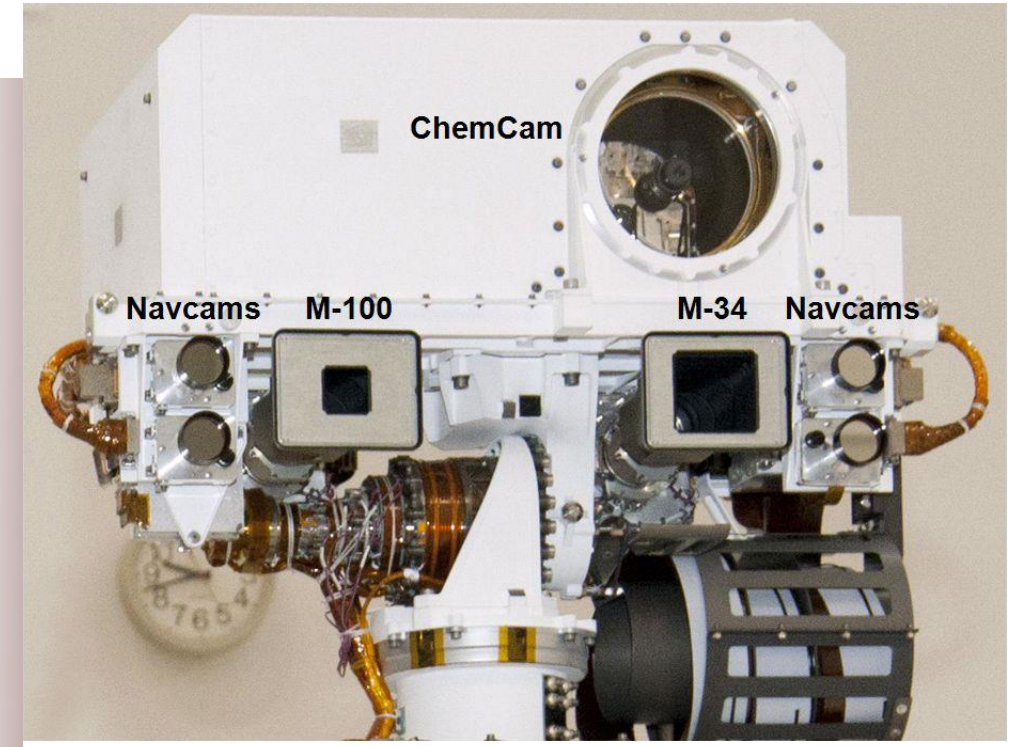
Computer vision for a mobile machine

- NASA Curiosity rover – Mars





Computer vision for a mobile machine

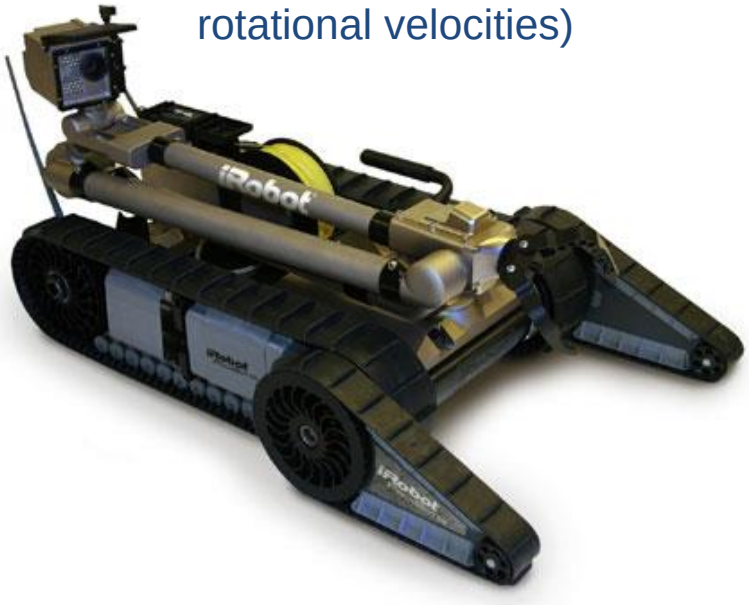
- Google self-driving car
  - Lasers
  - Radars
  - Cameras
  - Proprietary software

Availability: possibly by 2020

http://www.wired.com/2015/10/googles-lame-demo-shows-us-far-robo-car-come/

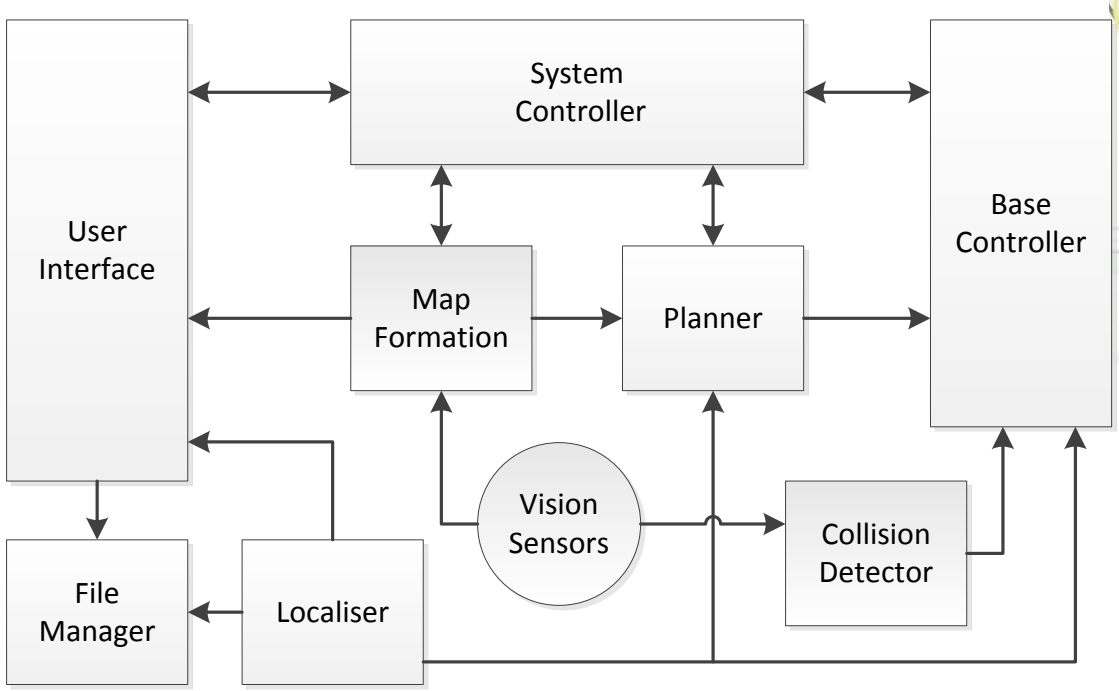
Computer vision for a mobile machine

- Robot system hardware
  - Wheels and frame
  - Electric motors
  - Batteries
  - Internal sensors
    - Odometry (wheel motion)
    - IMU (3D acceleration and rotational velocities)



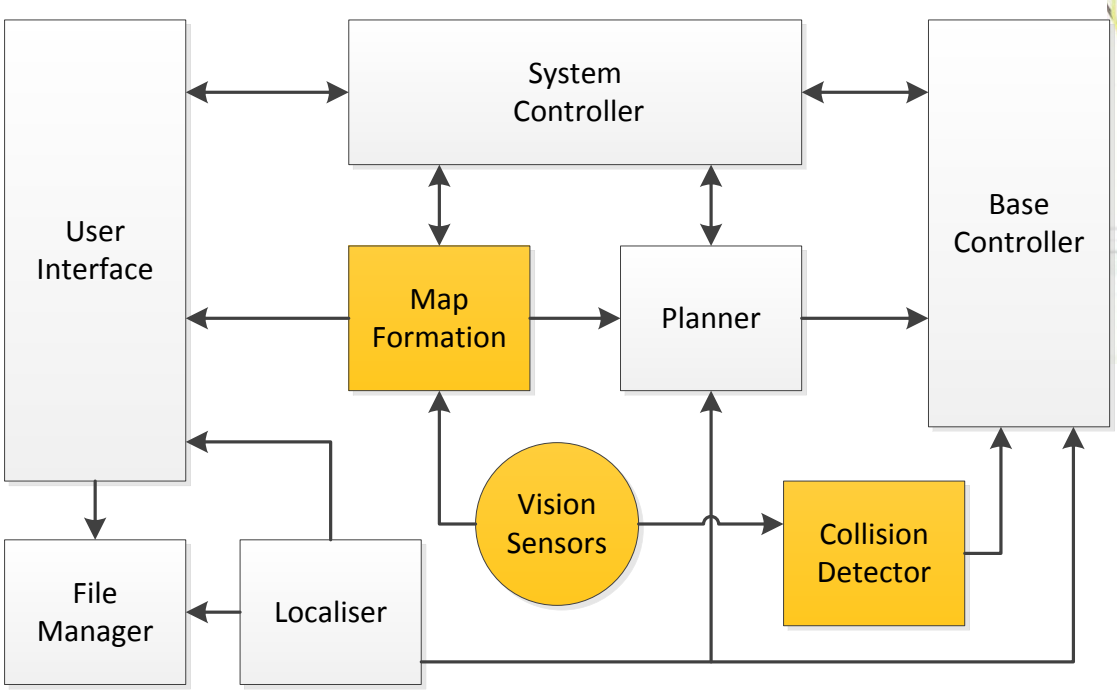
Computer vision for a mobile machine

- System software



Computer vision for a mobile machine

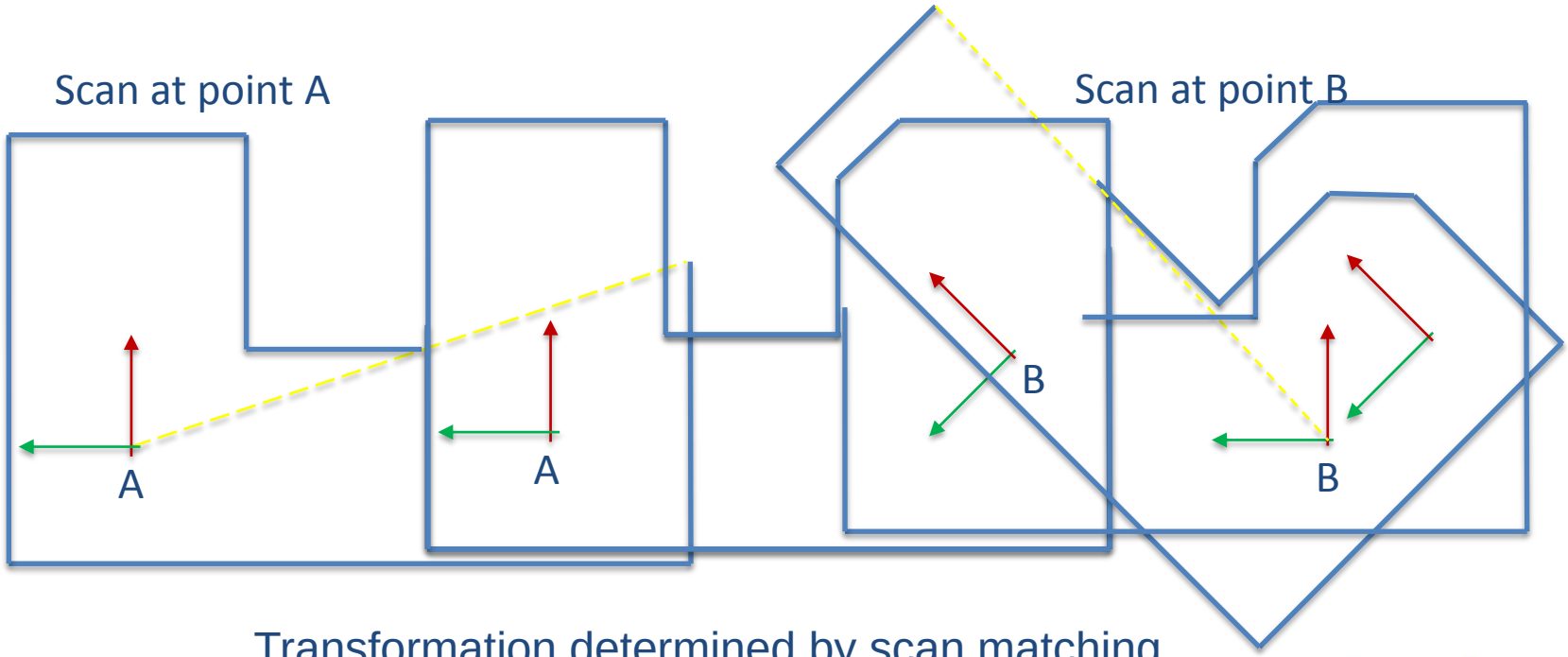
- Vision-related system software



Computer vision for a mobile machine

- Computer vision algorithm – Map formation:

Simultaneous Localisation And Mapping (SLAM) – Scan matching method



Transformation determined by scan matching
- develops the map
- gives the robot location within the map

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Example:
Autonomous exploration and mapping

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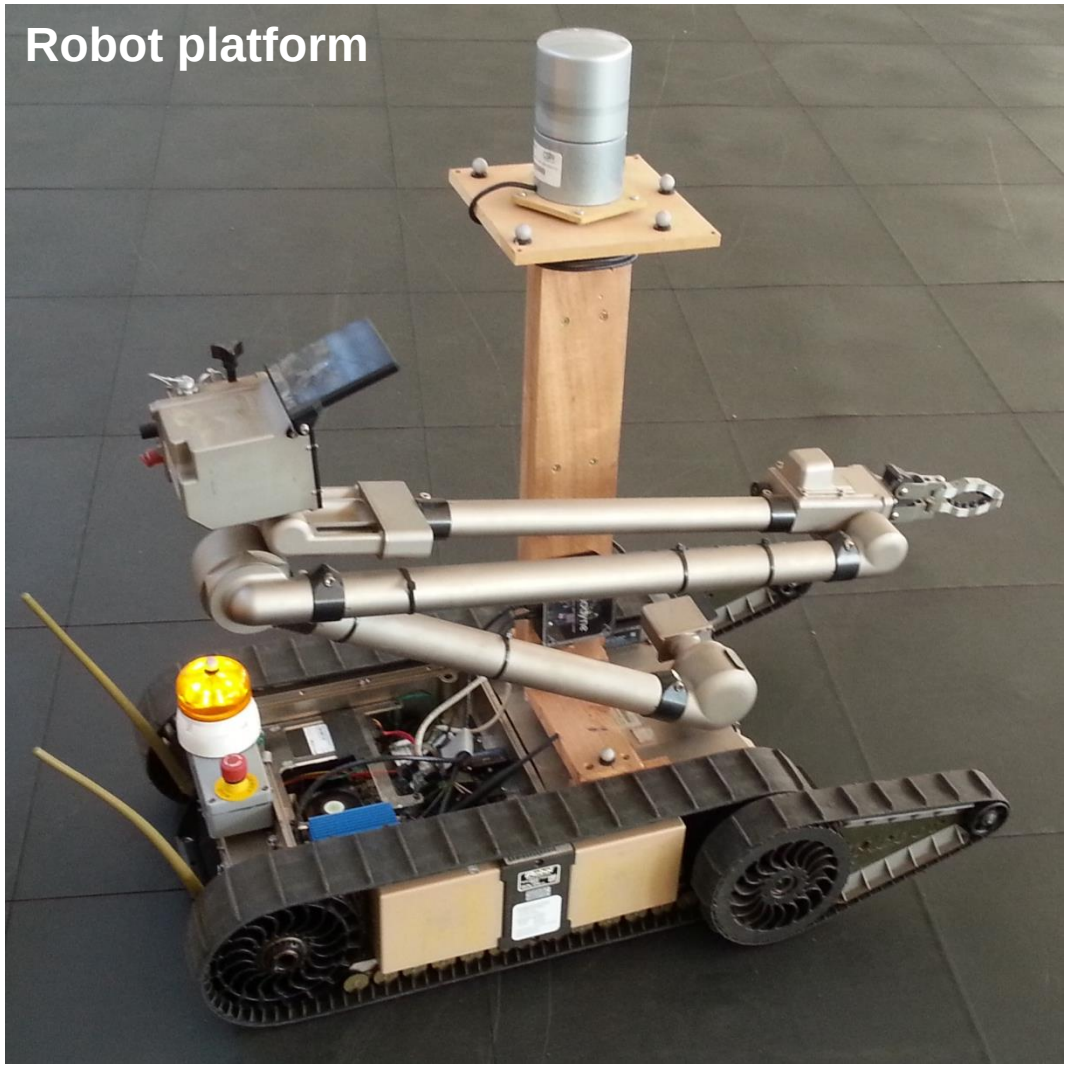
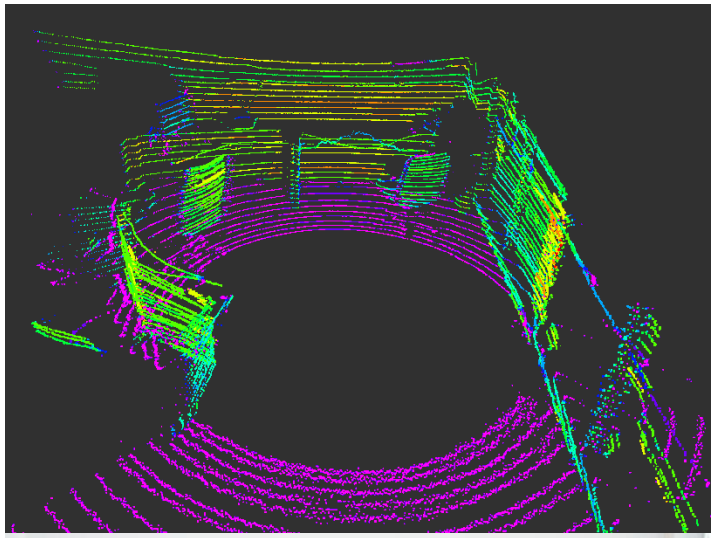
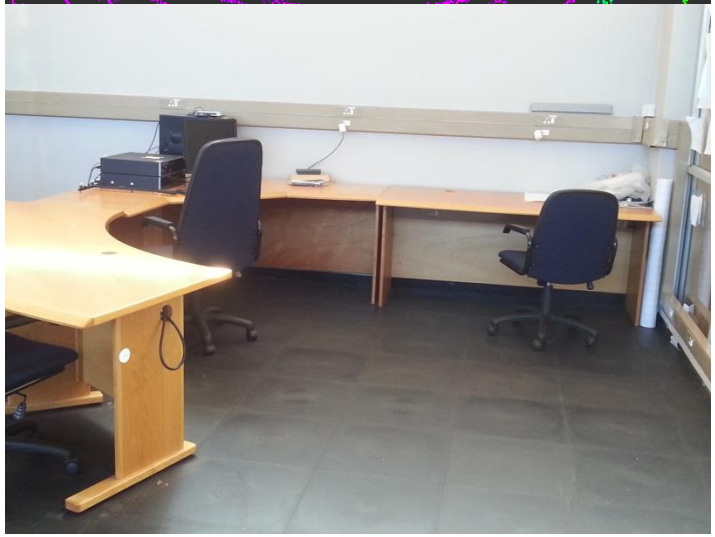


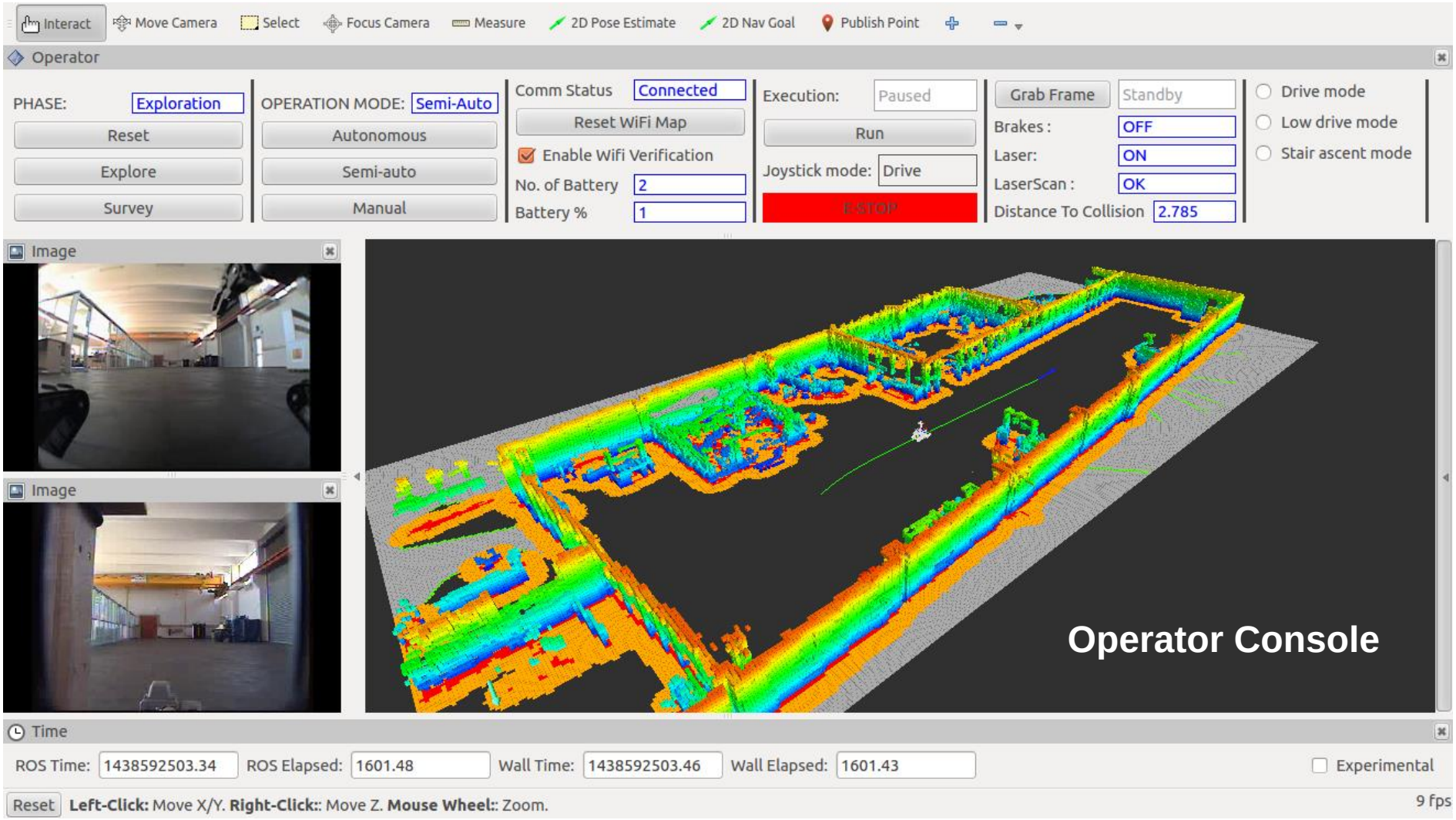
Autonomous exploration and mapping

- Primary vision sensor
  - 3D laser scanner
  - 32 laser beams





Autonomous exploration and mapping



Autonomous exploration and mapping

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Applications

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Applications

- Remote reconnaissance

Obtain information about a selected area/region from a remote location.

Examples:

- Public safety, police operations
- Hazardous materials detection
- Military reconnaissance operations

http://www.irobotweb.com/~/media/Files/Robots/Defense/iRobot-Nuclear-Industry-Applications.pdf?la=en

Applications

- Remote inspection

Remote scans of selected structures/materials

- structural integrity
- operational status

Remote – due to hazards or space constraints.

Examples:

- Liquid chemical storage tank
- Nuclear plant
- Damaged infrastructure

http://www.irobot.com/For-Defense-and-Security/Robots/510-PackBot#PublicSafety

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Summary

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Summary

- Computer vision:
  - sensors and analysis hardware/software
- Autonomous mobile robot:
  - Unconstrained environments
  - Artificial intelligence
  - Control own motion
- Applications:
  - Exploration and mapping
  - Remote reconnaissance
  - Remote inspection

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Thank you

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