

# MOBILE ROBOTS AND AUTONOMOUS VEHICLES

## INTRODUCTION

- How to program the new generation of mobile robots ?
- Primarily intended to students with engineering or master degree... *but any person with a basic familiarity with Robotics & Probabilities can benefit from it*

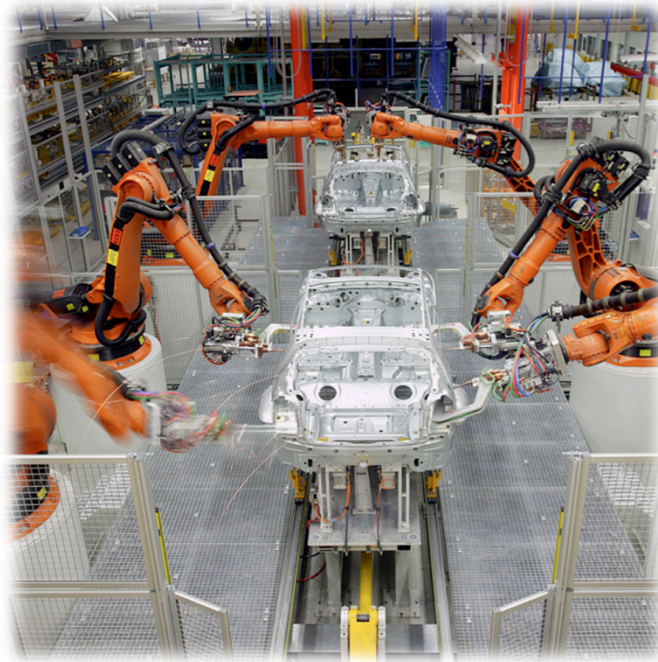


# Context

- “**Cobots**”: new generation of robots working in close interaction with human being

# Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Industrial sites with lines of cooperating robots*



# Context

- **“Cobots”**: new generation of robots working in close interaction with human being
- **Various environments**: *Public space (e.g. for mobility assistance)*





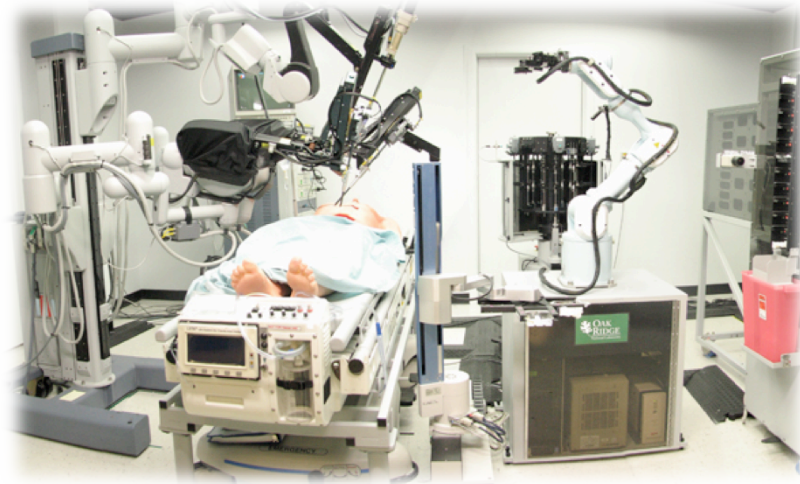
# Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Sustainable transportation Systems*



# Context

- **“Cobots”**: new generation of robots working in close interaction with human being
- **Various environments:** *Hospital (e.g. for surgery)*



# Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Home (e.g. companion robot)*



# Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments:** *Disaster areas for rescue ....*



# Context

- **“Cobots”**: new generation of robots working in close interaction with human being
- **Various environments**
- **Major challenge** for both Industry and Human Society

# Context

- “**Cobots**”: new generation of robots working in close interaction with human being
- **Various environments**
- **Major challenge** for both Industry and Human Society
- **New robots characteristics for:**
  - ✓ *Balancing **Safety, Efficiency, Autonomy** constraints*
  - ✓ *Addressing the novel problem of **Social Acceptability & Intuitive Human-Robot Interaction***

# Objective of the course

- Present **Key Concepts & Tools** for Programming Autonomous Mobile Robots & Vehicles
- Describe **Formal & Algorithmic tools**, illustrated using **Realistic examples**. Programming **exercises in Python** will also be provided.
- Particular attention to underlying **Bayesian approaches**



# Objective of the course

- The course is presented by 3 researchers from Inria :  
*Christian Laugier, Agostino Martinelli, Dizan Vasquez*



- It also includes contributions from *Stephanie Lefevre, Mathias Perrollaz, Lukas Rummelhard and Amaury Negre*

# Course plan

1. Objectives, Challenges, State of the Art, Technologies - *C. Laugier*
2. Bayes & Kalman Filters - *A. Martinelli*
3. Extended Kalman Filter, Observability properties - *A. Martinelli*
4. Perception & Situation Awareness & Decision Making - *C. Laugier*
5. Behavior Modeling & Learning - *D. Vasquez*

# Pictures & Movies

- p. 1:
  - Dragon Runner robot with QinetiQ operator by QinetiQ – Droits réservés
  - Cybus Véhicule intelligent – © Inria 2015
- p. 3: « Application field automotive » by KUKA Systems GmbH — KUKA Systems GmbH. CC BY SA 3.0 via Wikimedia Commons
- p. 4: Autonomous navigation in Human Environment – © Inria – E-Motion Team
- p. 5: Cybus Véhicule intelligent – © Inria 2015
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- p. 7: « PR2 Tabletop » by Willow Garage CC BY SA 3.0 via Wikimedia Commons
- p. 8: Dragon Runner robot with QinetiQ operator by QinetiQ – Rights Reserved