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Introduction to Mobile Robotics

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Class Schedule

- Monday & Wednesday from 8:00 a 10:00 hrs.
- Beginning
 - February 5th
- End
 - June 2nd
- Schedule modifications
 - Conferences and research stages



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Course Details

- An average of 60 hrs.
- Possibility of relevant topics by researchers in the field from LAAS, UG, UASLP, etc.
- Course evaluation:
 - Homeworks and projects (intercourse and final)
- It will be very Important participation in discussions about actuality themes.



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Course Details

- Communication preferred by email anmarin@uv.mx
- Docs will be available in :
 - <http://www.uv.mx/anmarin/cur-es.html>
- Eminus System (UV)



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References

- Ulrich Nehmzow, “Scientific Methods in Mobile Robotics”, Springer, 2006.
- Sebastian Thrun, Wolfram Burgard, and Dieter Fox, “Probabilistic Robotics”, MIT Press, 2005.
- Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki, Sebastian Thrun, “Principles of Robot Motion: Theory, Algorithms, and Implementations”, MIT Press, 2005



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References

- Siegwart R. and I. Nourbakhsh, “Introduction to Autonomous Mobile Robots”, MIT Press, 2004,
– 2nd ed. 2011
- Dudek G. and M. Jenkin, “Computational Principles of Mobile Robotics”, Cambridge University Press, 2000,
– 2nd ed. 2010



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Topics

- Introduction: Types of robots
- Locomotion
- Kinematics of Mobile Robots
- Perception
- Navigation
- Localization
- Path Planning
- Task Planning



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Type of Robots

- What's a robot?
- What can do a robot?
- Which are the main components of a robot?



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Type of Robots

- Manipulators vs. Mobile Robots
- Mobility
 - Limited range of action
- Locomotion is the first challenge
- Robots in hostile or dangerous environments are commonly teleoperated
 - Mars, ocean (Titanic), etc.



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Type of Robots

- Robots in Human environments
 - Require autonomy
 - Ability to maintain a sense of position
 - To navigate without human intervention



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Type of Robots

- Robots Classification:
 - Control type
 - Locomotion
 - Goals or tasks



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Type of Robots

Isaac Asimov laws of robotics

- A robot may not injure a human being or, through inaction, allow a human being to come to harm.



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Type of Robots

- A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
- A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.



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Type of Robots

- Asimov also added a fourth, or zeroth law, to precede the others:
- A robot may not harm humanity, or, by inaction, allow humanity to come to harm.



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Mobile Robots

- An area, dealing with the control of autonomous or semi-autonomous vehicles (Dudek 00)
- What is the difference regarding: Robotics arms, Artificial Intelligence and Computer Vision?
 - Mainly the work it is done at different scale



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Mobile Robots

- Task at big scales imply:
 - Knowledge Acquisition
 - Position error estimation
 - Detection and recognition of places and objects
 - Real-time response
- It is necessary to do these tasks, simultaneously and coordinately



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Mobile Robots

- The study on Mobile Robots can be break down into three sub-problems (Dudek 00):
 - To move into the environment
 - To sense the environment
 - To reason about the environment



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Mobile Robots

- It is not only a set of algorithms to: sense, reason and moving.
- They need to work on physical entities.
- The proposal should be deal with all uncertainties of the real world.



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Mobile Robots

- The motion is essential
- There are a few living creatures that can not move or to do spatially distributed tasks in their environments



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Mobile Robots

- Interdisciplinary Research
 - Mechanical Engineering
 - Computer Science
 - Electrical Engineering
 - Cognitive Psychology, perception and neurosciences.



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Mobile Robots

- Robots can be considered from different perspectives.
- From a physical level (hardware) we have:
 - A device to move the robot in the environment
 - One or more computers to control the robot
 - A set of sensors
 - Communication Hardware



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Mobile Robots

- From a computational field of view:
 - A subsystem of motion control
 - A subsystem to acquire data from sensors
 - A subsystem to interpret sensors data



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Mobile Robots

Questions?

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