DD2426 Robotics and Autonomous Systems HT2008

Patric Jensfelt

Robotics and Autonomous Systems DD2426

Welcome!

Long tradition since 1995

New approach this year

Robotics and Autonomous Systems DD2426

The crew

- Patric Jensfelt (patric@kth.se)
  - "lecturer"
- Jorge Sanchez de Nova (jssdn@kth.se)
  - Project guru

Robotics and Autonomous Systems DD2426

Course homepage

- Web page for the course

  http://www.csc.kth.se/utbildning/kth/kurser/DD2426/robot-h08/

- This is is where you will find information

Registration

- Fill in registration list
- Mark your skills

Rough outline

- Lectures (theory)
- Project (proctice)

Idea behind course

- Put the knowledge you have acquired in other courses to use
- Learn about robotics
- Solve a complete and “real” problem, i.e.
  - From start to finish:
    - Analysis, design, implementation, testing
  - Covering many different areas:
    - Mechanics, programming, control, estimation, vision, ...

Lectures

- Most lectures will not be conducted in the traditional “preacher” style
- You prepare the lectures!
- We split the chapters between you

Intended learning outcomes

- After the course you should be able to
  - Explain basic concepts and technologies in robotics
  - Explain possibilities and limitations today
  - Communicate knowledge orally and in writing
  - Analyze a problem from a holistic viewpoint
  - Develop a strategy and solve a problem with methods and tools available
  - Make decisions based on acquired knowledge
  - Assess quality of your work and that of others
  - Work in a project setting

Robotics and Autonomous Systems DD2426

Examination (Theory)

- Explain basic concepts and technologies in robotics
- Explain possibilities and limitations today
- Communicate knowledge orally and in writing
  - The EXAM at the end is scrapped
  - Active participation in lectures
  - Write short reflection + open questions on book material before each lecture
  - Might probe your knowledge
  - Prepare one lecture in group

Robotics and Autonomous Systems DD2426

Examination (Theory)

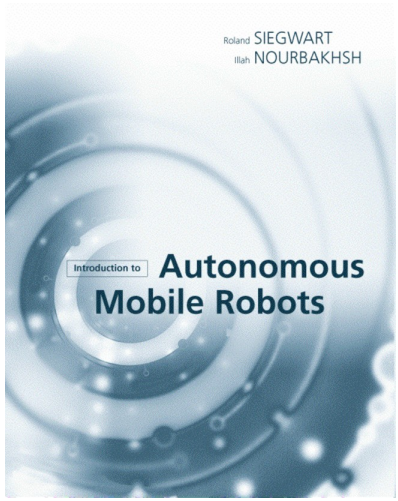
- The assessment of this is pass/fail
- Want to promote understanding and deep learning rather than memorizing stuff

Robotics and Autonomous Systems DD2426

Examination (Theory)

- Write (1 page reflection on each chapter) + (list open questions for a discussion). Should be handed in before or at lecture.
- Possibly a quiz
- Prepare in a group a 45min presentation of the material in one of the chapters
- Active participation in 5 workshops/lectures (one per chapter)

Course book



Robotics and Autonomous Systems DD2426

Lectures

- This will be the focus of the first part of the course
- Each “book chapter lecture”
  - Hand in preparation (EVERYONE!)
  - 45 min presentation (one group)
  - 45 min discussion (EVERYONE!)
- Chapters (select via doodle)
  - Locomotion
  - Kinematics
  - Perception
  - Localization and mapping
  - Planning and navigation

Robotics and Autonomous Systems DD2426

Examination (Practice)

- Communicate knowledge orally and in writing
- Analyze a problem from a holistic viewpoint
- Develop a strategy and solve a problem with methods and tools available
- Make decisions based on acquired knowledge
- Assess quality of your work and that of others
- Work in a project setting
  - Project work

Robotics and Autonomous Systems DD2426

Examination (Practice)

- In group
  - Make a project plan (for your use)
  - Solve a “real” world problem
  - Write a project report
  - Present the work
- Individually
  - Write a 1 page statement about what you hope to learn
  - Keep a log of what you do and how much time you spend
  - Report after the course on
    - Reflect on your work in the project
      - How did it match your expectations? What did you spent time on? What did you learn?
    - Reflect on the work of the group
      - What worked in the group, what did not? Analyze the work
  - Comment on 1 other group report

Project “workshops”

- Will organize workshops along the way to
  - Instructions about hardware
  - Help with common problems
  - Discuss progress
  - Discussion solutions (if you want to share)

Robotics and Autonomous Systems DD2426

Project “Robot rescue”

Picture from www.dis.uniroma1.it/~iocchi/

Robotics and Autonomous Systems DD2426

“Robot rescue” in DD2426

- Go into a maze and “rescue” orange golf balls
- Need to find your way in
- Find the golf balls
- Find your way out with the balls

- Performance metric
  - Do it as fast as possible “the victims are dying!”
  - Innovative solutions

Robotics and Autonomous Systems DD2426

Skills needed to solve the task

- Mechanical design
- Estimation
- Control
- Computer vision
- Electronics (maybe)
- Programming high/low level on embedded platform
- Project management
- Reasoning

Robotics and Autonomous Systems DD2426

What we hope that you will pick up

- Insight into embedded platforms and programming
- Know how to adapt a solution to the resources available (software, hardware, time, space, weight, etc)
- Overcome problems with imperfect env
- Work with open-ended problem definition
- System integration is HARD => do not underestimate it in the future!

Robotics and Autonomous Systems DD2426

Project groups

- 4 in each group
- Diversity please!!!!!
- Each group member must present a different chapter in the book

Robotics and Autonomous Systems DD2426

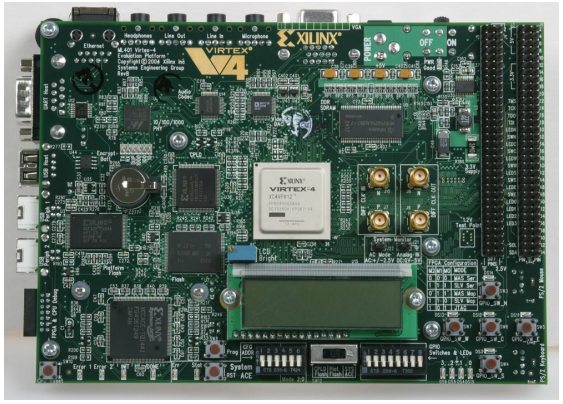
Lab space

- 1535 (CSC main building, 5th floor)
  - Computers (1 linux PC per group)
  - Soldering
  - Test maze
- 1621 (CSC main building, 6th floor)
  - Workshop

Robotics and Autonomous Systems DD2426

Hardware

- Embedded platform
- Requires low and high level programming



Additional stuff

- Motors and wheels
- Sensors (IR, sonar, camera, compass, gyro, bumpers, accelerometers)
- Servos
- Metal to build with

Robotics and Autonomous Systems DD2426

- Not allowed to use off-board processors
- Can add I2C and SPI devices, or anything that is attached to the general purpose pins
- Can reconfigure FPGA if you know how