Introduction to (educational) robotics

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Robots

- ”robota”: mechanical or forced labour
- Artificial ”life” created by a human (“robots”) has existed throughout history (eg. Golem in Jewish folklore)
- Robots are very famous in popular culture
  - Sci-Fi movies
  - Terminator
  - Star Wars, A.I, I – Robot, ...

What is robot?

- Artificial life, that is, imitating living creatures
  - Walking humanoid robots
  - Flying nano-robots
  - Snake-like rescue robots
- Mechanical device which can react for the stimulus coming from the surrounding environment
  - Moving, manipulation of the environment

What is robot?

- Precise definition is rather hard
  - Autonomous working
- Virtual robots?
- From technical point of view:
  - Programmability
  - Mechanical capabilities
  - Flexibility

The 1940 Laws of Robotics

- First Law: *A robot may not injure a human being, or, through inaction, allow a human being to come to harm.*
- Second Law: *A robot must obey orders given it by human beings, except where such orders would conflict with the First Law.*
- Third Law: *A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.*

Structure of robot

- Sensors
  - Information collection
  - Touch sensor, radar, microphone, IR sensor, temperature, rotation sensor, GPS, ...
- Actuators
  - Motors, wheels, belts, propels, ...
  - metamorphosis

Structure of robot

- Processing
  - Sensor information
  - Controlling the actuators
  - Data storing and manipulation
  - Can be internal or external

Structure of robot

- Communication
  - Communication between processing unit and sensors/actuators
  - Communication between robots
  - Communication between user and robot
    - Robot's internal state
    - Delivering of collected information
    - External data processing

Usage of robots

- Mechanical tasks in factories and logistic centers
- Dangerous (for humans) tasks
  - Rescue tasks, military operations
- Entertainment
  - Sony Aibo
- House holding
  - Vacuum cleaner

Usage of robots

- Social robots
- Educational robotics
  - Lego Mindstorms

Educational robotics

- Same principles apply also for educational robots
  - Motivation for students
  - Successful and unsuccessful teaching experiments
- Cheap price and flexibility are crucial
- More about educational robotics on the next time
  - Pedagogical and technical issues
  - A crash course in how to use Lego Mindstorms

A group task

- Form a group of x students
- Check some of the links at the course web page and think how (educational) robotics could be applied in the courses you have been studying in our department (15 mins)
- Short presentations (5 mins) for rest of us
  - What course(s)? How to apply? What techniques to use?

First individual task

- Based on the materials and discussion in the lecture, write a short (~1 page) essay about what kind of robot you dream about. What the robot should do? What it shouldn't do? What are the main challenges when implementing such a robot?
- Return your writing to ijorma@cs.joensuu.fi by 1 November, 8am with email subject “IMPTECH: Task 1”
- Feedback will be provided