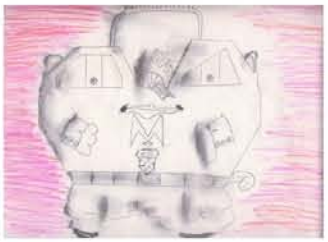



From LEGO to youBot: a new education path in service robotics

Paolo Fiorini
Altair Robotics Laboratory
Department of Computer Science
University of Verona, Italy



Presentation Outline

Challenges in Robotics Education

Solutions adopted in the past

Device driven curricula

Robots are Coming

Scientific American, December 16, 2006

A Robot in Every Home, By Bill Gates

The leader of the PC revolution predicts that the next hot field will be robotics

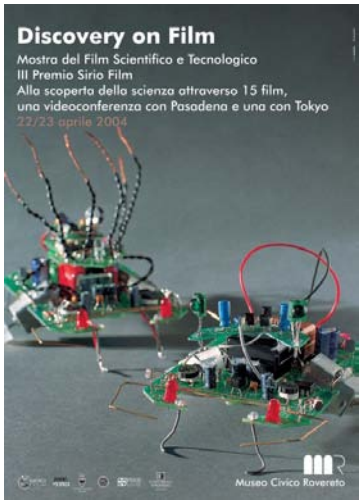
This statement was a bit premature, but it motivates the need for addressing robotic education in a different way than current academic programs

Past Approaches

- Programs have included:
  - Scientific Festivals
  - Student seminars and lectures
  - Teacher seminars and courses
  - Organization of broader activties
- However, the results have been very limited and with little impact, thus the need to develop a new strategy.
- No quantitative measurement has been put in place.

Scientific Festivals for Youngsters

- Discovery on Film, in cooperation with the Natural Sciences Museum of Rovereto
- Typical program includes (since 2001):
  - Scientific films in the morning with discussion and Q&A
  - Lectures in the afternoon for teachers and students
  - Lectures in evening for the general public
  - Exhibits of science projects (high and middle schools) and research projects



High School Courses

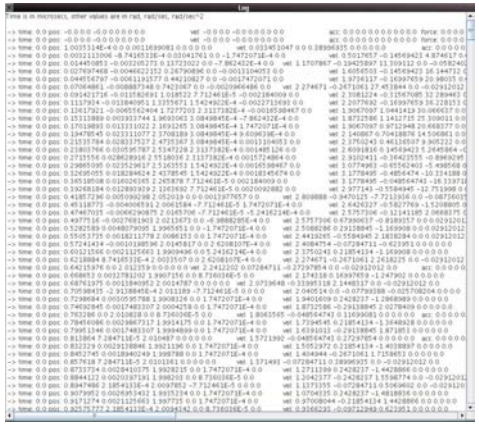
- High Schools:
  - Review of state of the art in robotics
  - Review of basic technologies
  - Description of robotic projects
  - Formal courses on Robotics and Automation in HS (with HS teachers)
  - Joint HS-University courses (Tandem)
- Middle Schools:
  - Focus on LEGO as a learning tool
  - Focus on general scientific subjects

College Courses

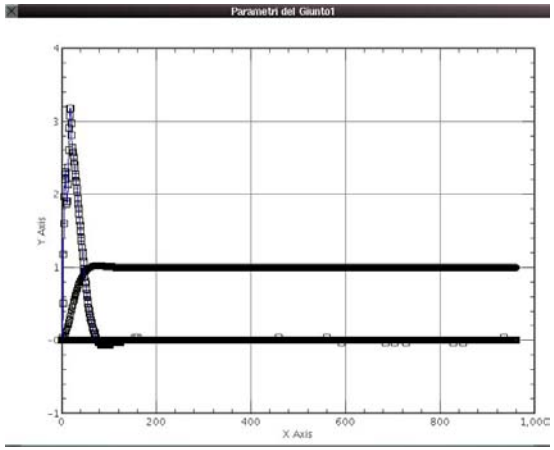
The RoboticsCourseWare initiative:

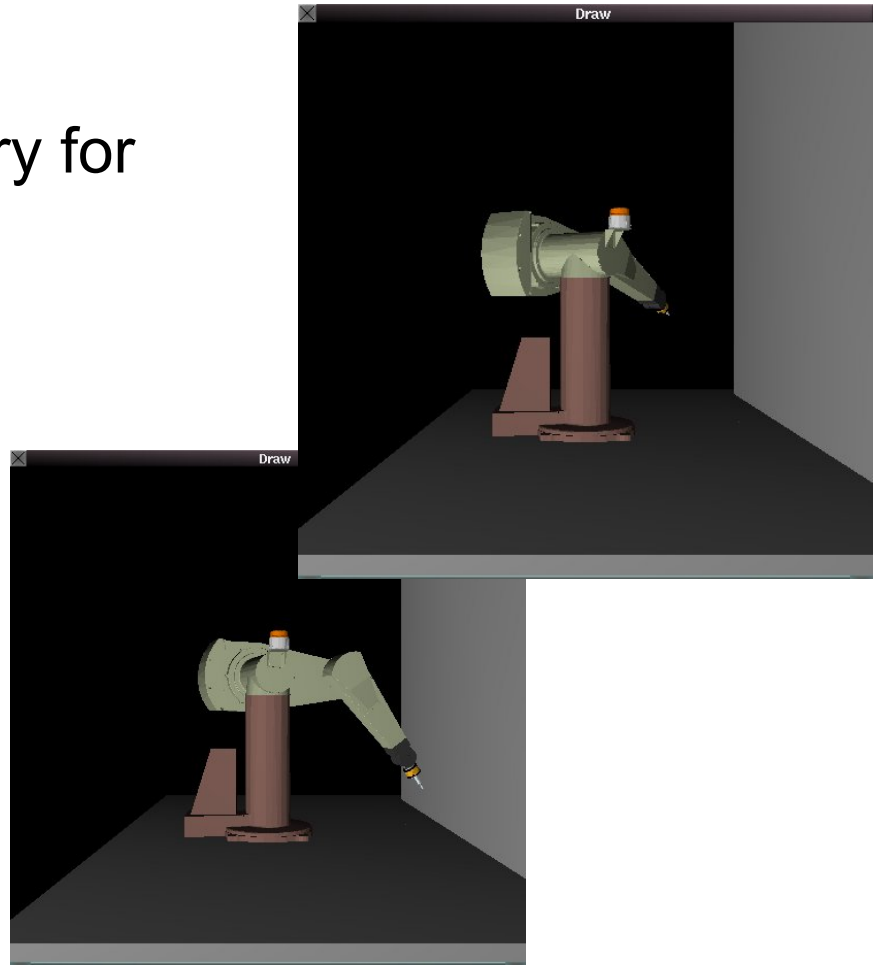
- Started in 2007 with a grant from IEEE R&A Society
- Aims at collecting lecture material from known researchers and put it on the web, in a copyright free form.
- It included 4 courses:
  - Introduction to Autonomous Mobile Robots (EPFL), October 2003 - February 2004
  - Introduction to Robotics (Harvard University, ES 159/259), Spring 2007
  - Motion Planning and Applications (NU Singapore, CS5247), Semester 1, 2006-2007
  - Robotics: Science and Systems (MIT, CSAIL 6.141), Spring 2007
- New courses to come before the end of the year

Virtual Laboratories

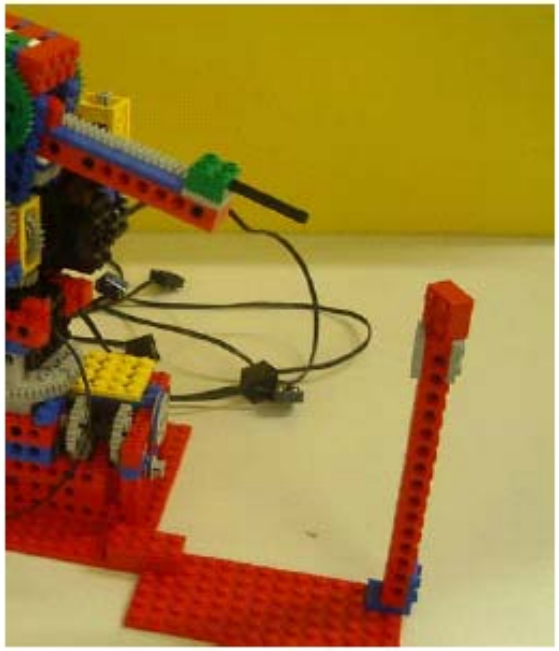


Virtual laboratory for robotics teaching

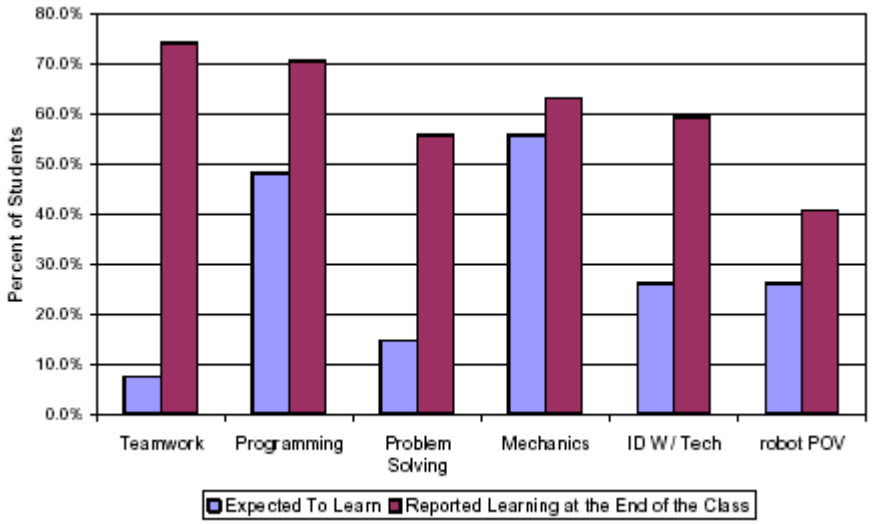




The CMU-RI experience (2004)



CMU Results



No significant differences from what boys and girls state to have learnt

Girls have started with less confidence, ma show the largest increase in confidence at the end of the course.

Some comments:

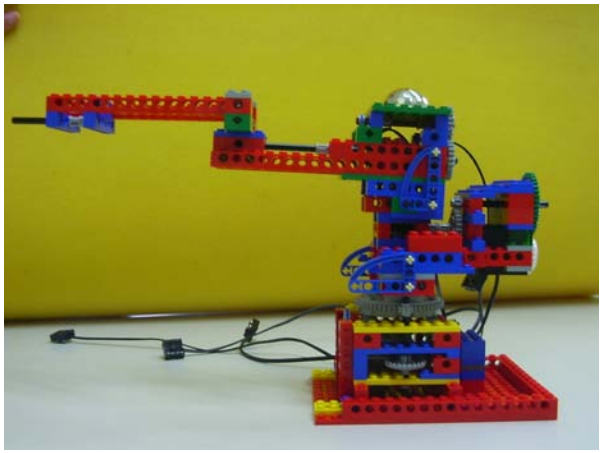
It deos not matter how difficult the problem is, we are able to solve it.

I learnt to be more confident in my own capabilities

Team work requires lots of communication

I learnt that is better to do something slowly than doing it twice.

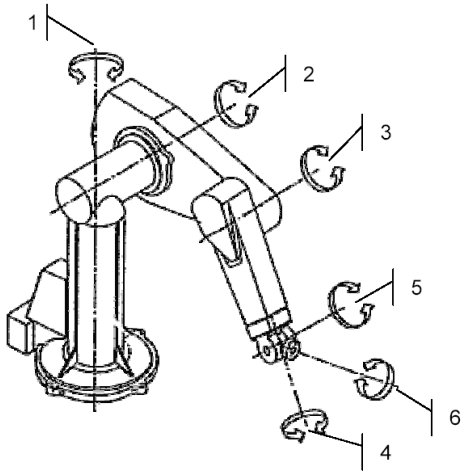
TANDEM @ UNIVR



Andrea Castellani e Stefano Galvan Università di Verona -- 2002-2008

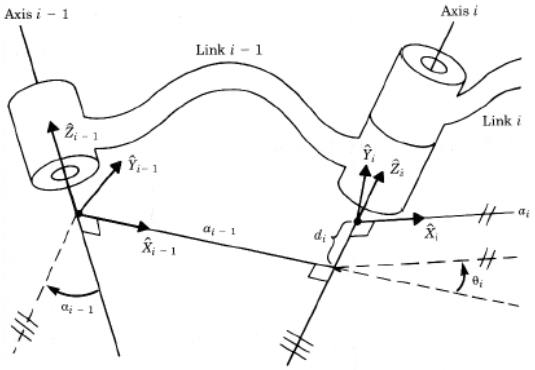
Kineplay Structure

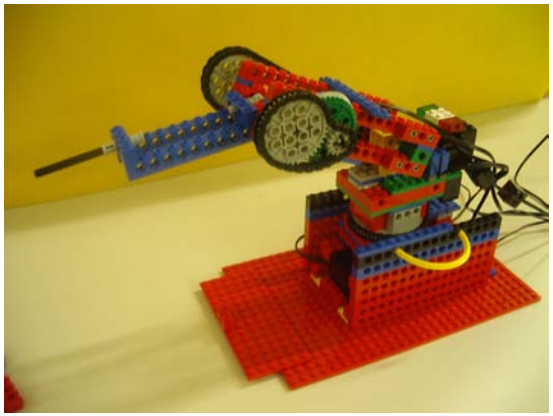
- Mathematical background (20 h)
  (matrices, transformations..)
- Robot Kinematics (10 h)
- Laboratory experiments (12 h)
- Self booting memory pen



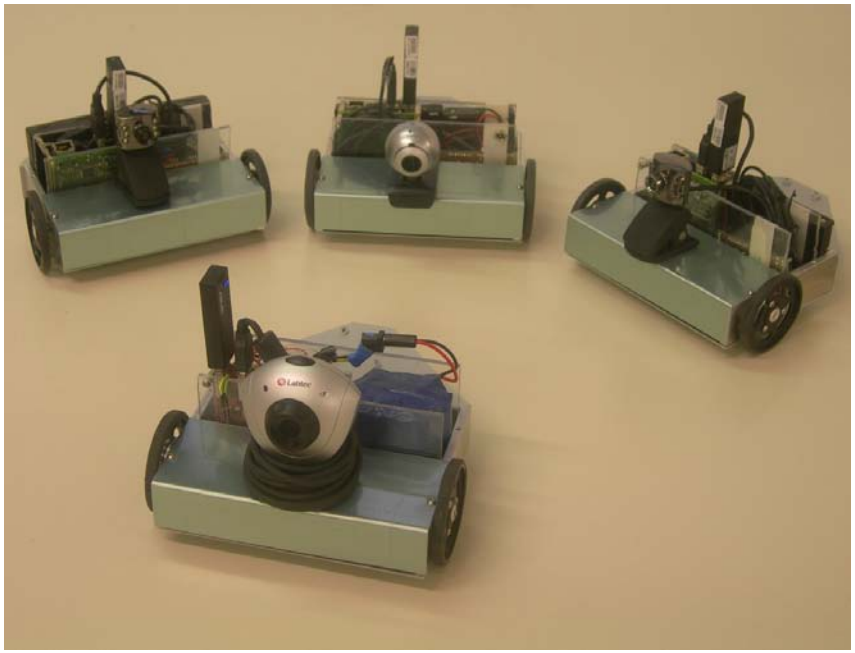
PUMA 200

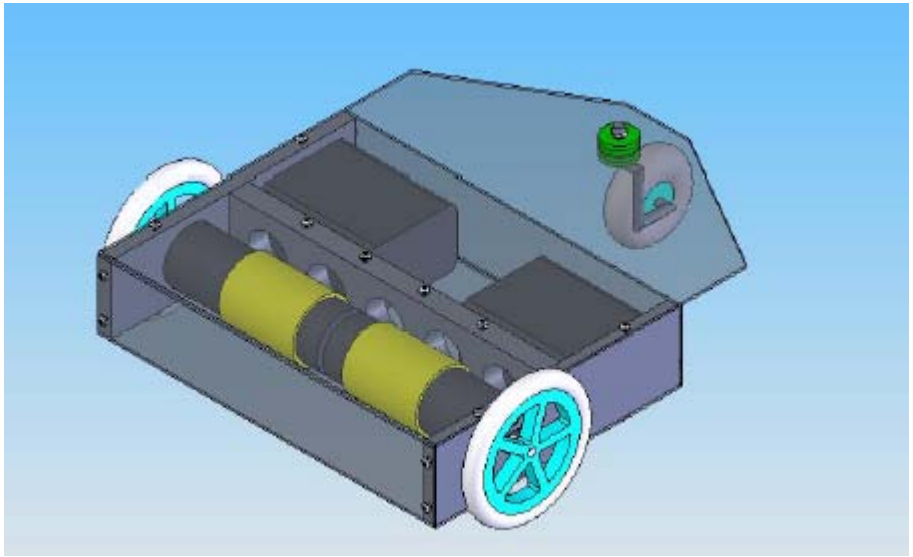
PUMA 500

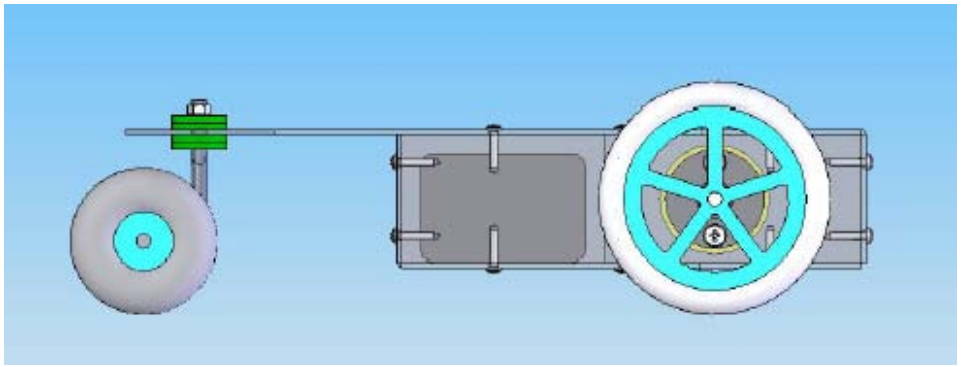




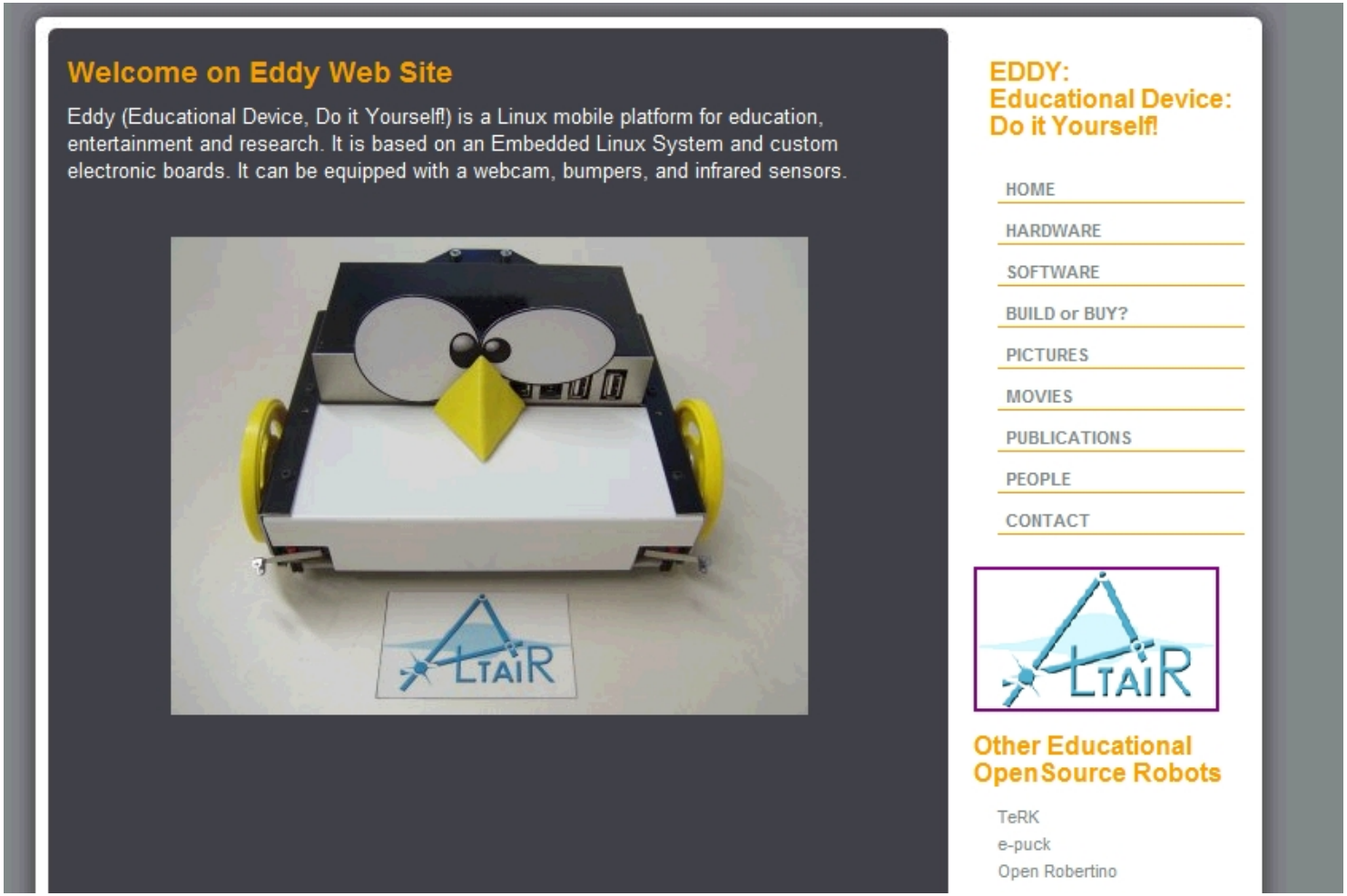
Eddy Educational Robot





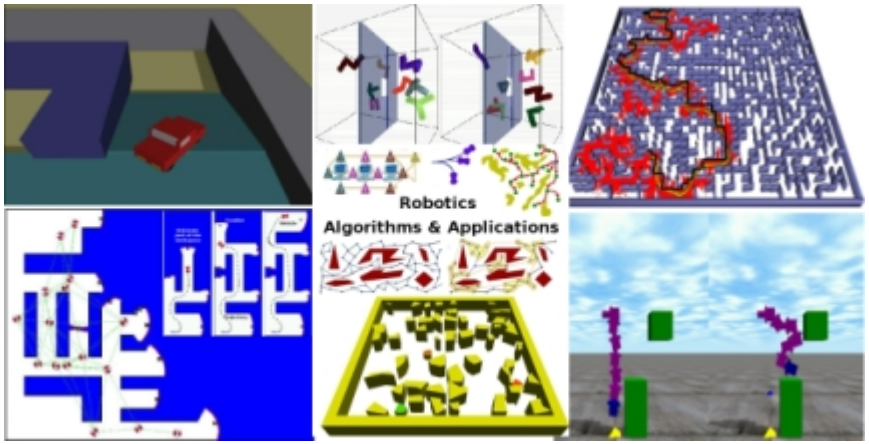


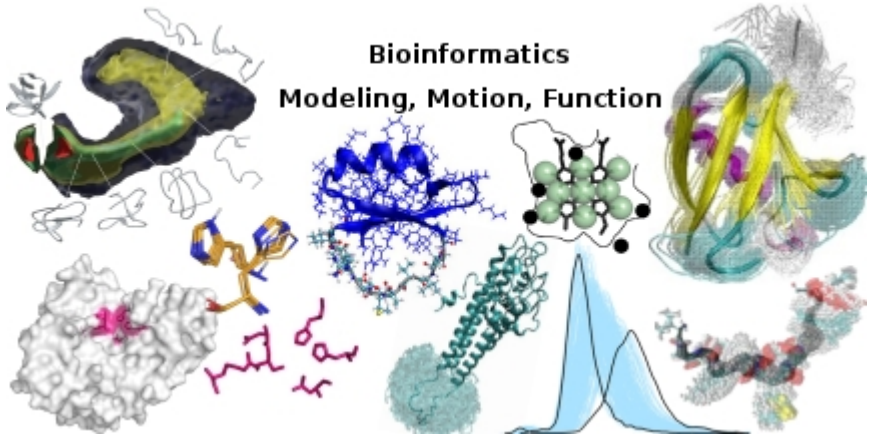
Open Hardware and Software System



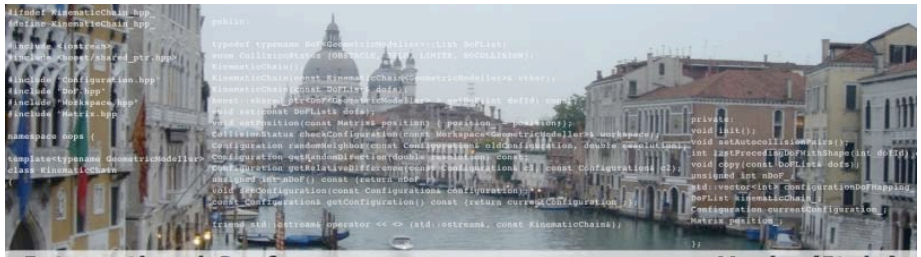
Planning and Execution Software

Kavraki Lab





Doctoral Courses



International Conference on SIMULATION, MODELING and PROGRAMMING for AUTONOMOUS ROBOTS (SIMPAR 2008)

Venice(Italy) November, 3-7 2008

IEEE Robotics and Automation Society (RAS) and
International Foundation of Robotics Research (IFRR)

School of Robotics Science on Learning

Lazise, Italy, September 24-28, 2007

Background

The development of robust and intelligent service robots requires very advanced capabilities, especially from a cognitive point of view. Even in simple applications, a service robot needs to understand complex and dynamic situations, for which no pre-programmed function can be fully satisfactory. Thus the robot must continuously adapt to its changing world and develop ways to address, and possibly carry out, instances of problems for which it has not been instructed in advance. For these reasons, learning new skills, new settings and new ways to carry out a given task is one of the prerequisite of future service robots.

Goals

The 4th IEEE-RAS/IFRR Summer School aims at exploring various learning paradigms that have been proposed for robotics systems and, in particular, will pursue the ambitious objective of comparing their performance in a given situation.

Lectures

Lectures will address learning methods, among which the most prominent are:

- learning classification and regression trees
- rule-learning
- neural networks
- reinforcement learning
- autonomous discovery
- skill learning

The laboratory part of the school, will be organized so that students will be able to use the learning tools available on laboratory robots and data sets for machine learning.

PublicColloquium

A workshop will be held on the first day to summarize the state of the art in robotic learning and its main applications.

Application

PhD students and postdocs are encouraged to apply. Attendance is limited to 40 students only. Details regarding cost of tuition and participation in the school will follow. It should be noted that students may only participate if they attend the entire week.

In order to be considered for participation, students are required to submit an application (in pdf) containing the following information:

Name and contact details, curriculum vitae, one page description of relevent current research project(s), motivation for participation, a letter/email of recommendation from their supervisor.

Applications for participation must be sent to both the organizers by electronic mail paolo.fiorini@univr.it and erwin.prassler@fh-brs.de no later than July 1, 2007.

Organization and coordination:

Paolo Fiorini, University of Verona
Erwin Prassler, University of Applied Science Bonn-Rhein-Sieg

Scientific Advisors:

Ivan Bratko, University of Ljubljana
Rüdiger Dillman, Universität Karlsruhe

For all the lastest information (including registration, accomodation, academic and social programme,

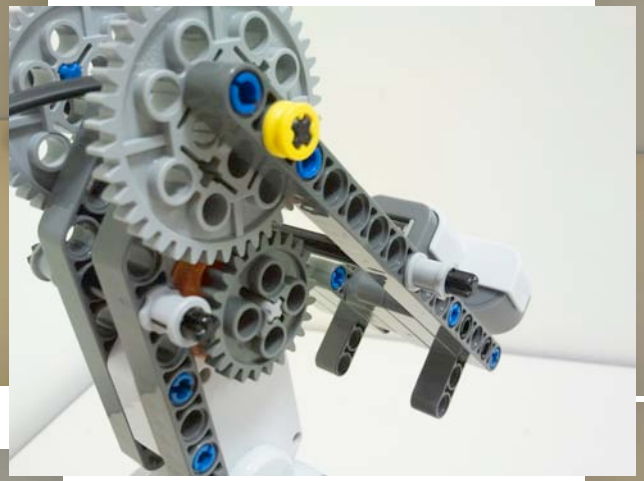
Limitations of the “Standard” approach

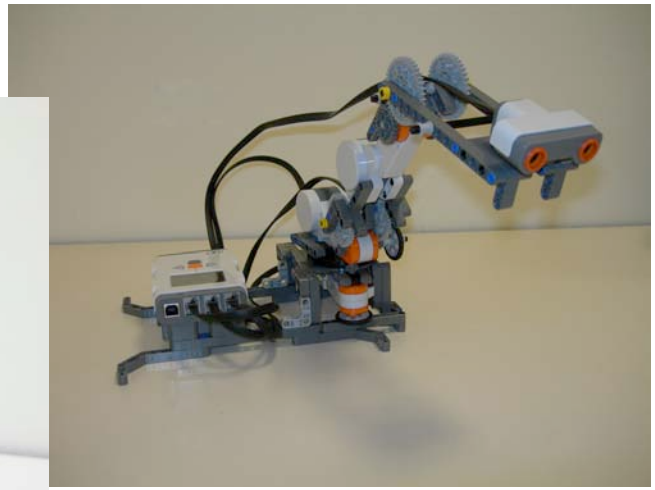
- It takes long time
- Does not address the needs of new jobs
- Does not match the complexity of real tasks
- Research oriented not “use” oriented
- There is no equivalent of “integrators” in Service robotics

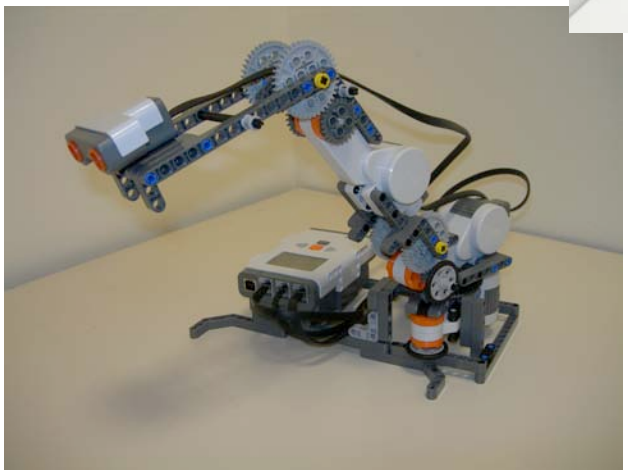
- Thus the need of a new approach: the EDUFILL project.

- Develop professional compentences without the need of a doctoral degree

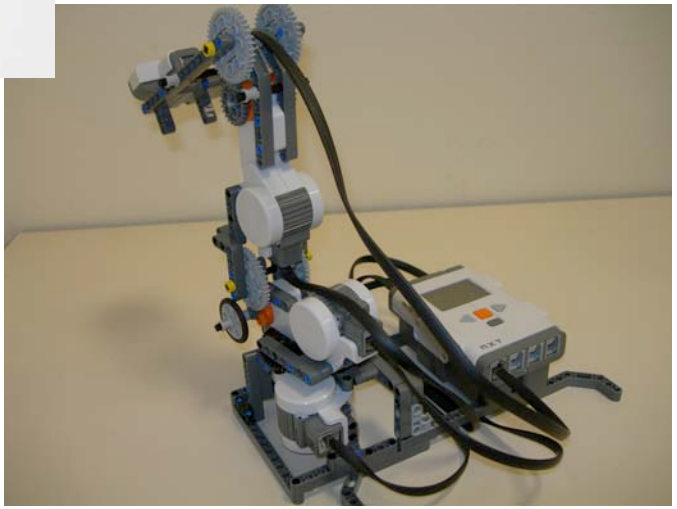
Using Commercial Hardware: a LEGO NXT arm







Do not invest in harware development but in curricula




LTAIR

Develop a Curriculum for youBot

Thank You for Your attention!