

DD2426 – Robotics and Autonomous Systems

Lecture 1: Introduction

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Outline

- Examples of swedish robotics
- Some application domains
- A case study
- Video from last year

Swedish robotics

- Sweden has traditionally be quite strong in robotics
 - ABB - industrial robots
 - Electrolux - vaccuum cleaner
 - Husqvarna - lawnmower

ABB - Industrial robots

- Car industri for spot welding, spray painting, ...



Husqvarna - Autonomous Lawnmower

Robotic Lawnmowers



 Husqvarna



Electrolux Autonomous Vacuumcleaner Trilobite



Autonomous?

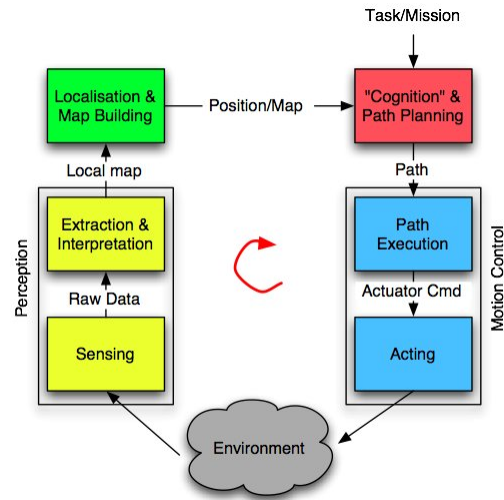
- The robot should be able to operate in an environment where not everything is known a priori
- React to unforeseen events
- Make decision based on sensor input

Mobile?

- Traditional (industrial) robots are bolted to the floor
- Are very good at what they do, but
- They cannot move!

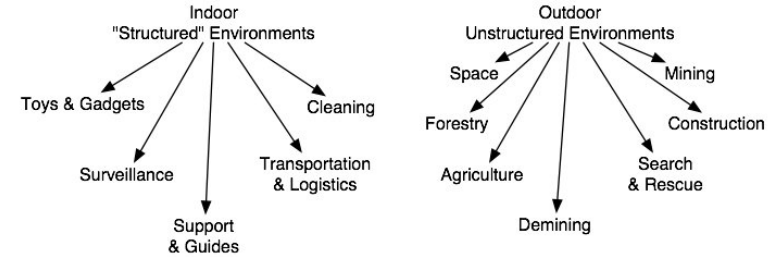


System overview



Applications

- Applications quite different indoor and outdoor



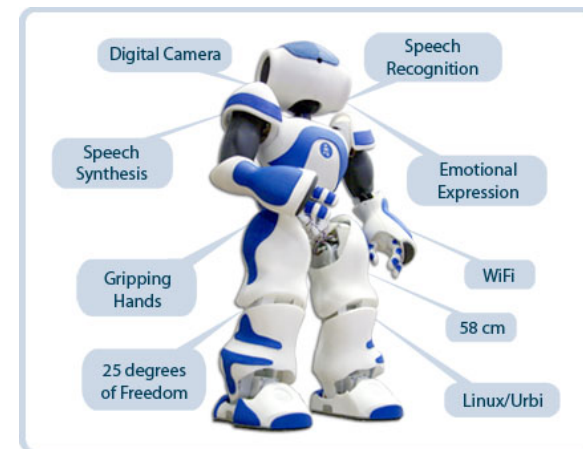
Toy example

- The Sony AIBO intended initially as a companion
- Price about \$2000
- RoboCup 4-legged league
- Now discontinued



Successor of Aibo in Robocup

- Nao new official platform for Robocup Standard League from 2008



More toys

Entertainment-Robots



SONY QRIO (J)



Sanyo Flatthru (J) auf der ROBODEX, 2003



Sony AIBO, ERS-7M2 (J) Partner-type Personal Robot (PaPeRo), NEC System Technologies, Ltd. (J)



TOYOTA MOTOR CORPORATION (TMC), (J)



Mona, Oskar, Opel Rüsselsheim (D)



"Banyu", tmsuk Co., LTD. and Sanyo Electric (J)



Wakamaru, MHI (J)



RoboX Bluebotics S.A. (CH)

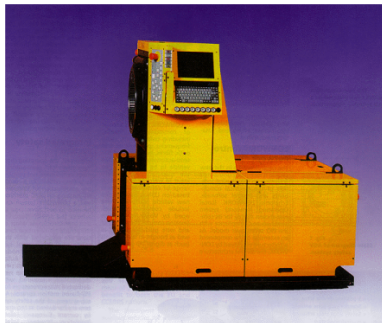
Guide robots

- Popular at museums
- Helps for elderly



Logistics and transportation

- In Volvo Factories many of the transportation tasks are automated such as motor transport, supply chain, etc. AGVs for special purpose platforms for transportation of goods
- More than 4000 vehicles in use by Volvo at its factories



Logistics and Transportation

- Material delivery in hospitals
 - Nurses spend > 10% of their time on transportations



Cleaning

- One of the first application domains
- Electrolux first on the market
- Now many different brands

Roomba and Scooba from iRobot



- Over 2 million Roombas sold

Commercial cleaning

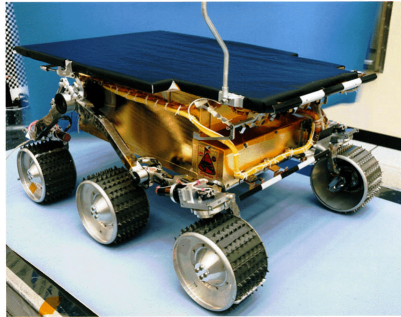


Outdoor applications

- Forestry
- Search and rescue
- Space and exploration
- 3D: Dull, dangerous and dirty

Space exploration

- Sojourner, Spirit, Opportunity
- Go beyond human reach



Search and rescue

- 8 robots were used at WTC 13 Sept 2001
- “Bomb” robots (used by police, firedepartment and military)
- Often teleoperated



Some robots at KTH



Robot technology in everyday products

- Robot technology is sneaking up on us
- Small steps at a time
- What was science fiction yesterday is everyday technology today
 - Car keeping distance automatically, collision checking
 - Quality control
 - Navigation systems for cars, planes and boat
 - ...

Androids



by Hiroshi Ishiguro

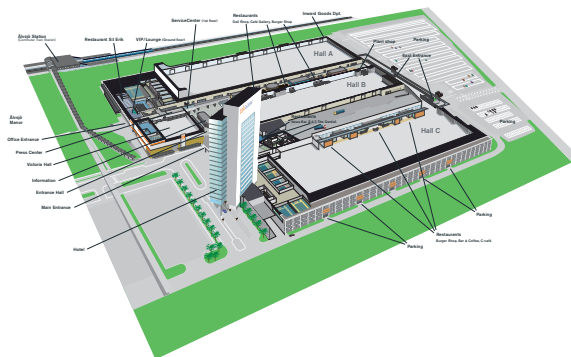
Raises questions about ethics. What are we allowed to do with robots?

Building a robot system

- Many components are needed to build a robot system
- The field is highly inter-disciplinary
- Study a “simple” test case

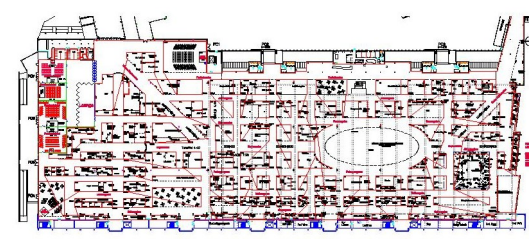
Floor marking at Stockholm International Fairs

- 70 regular fairs
- 1.000 congresses, conferences and seminars a year.
- 3 main halls, total 56,500m²

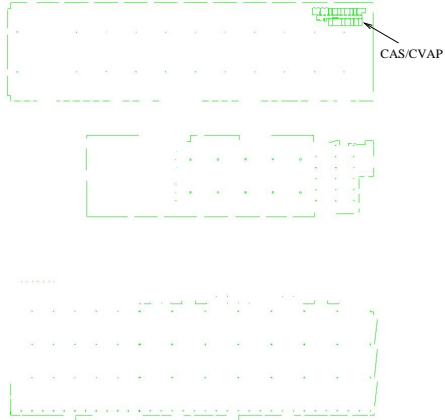


Marking the stands

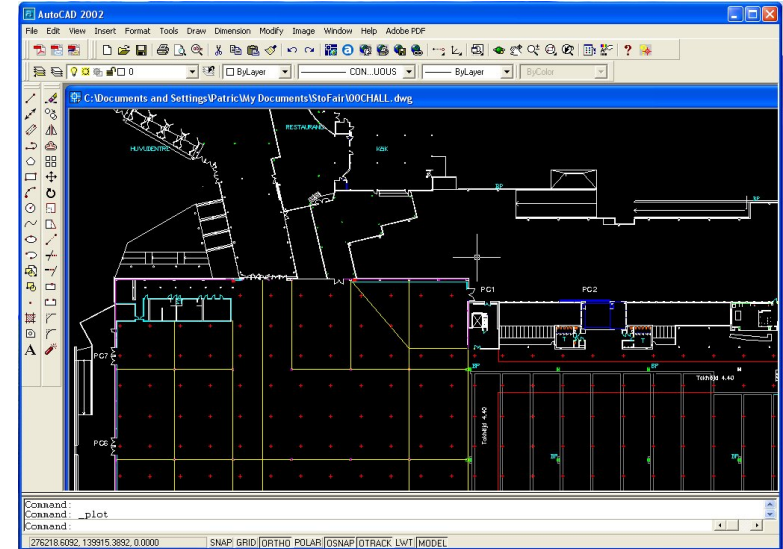
- Flexible layout
- Manual labour with tape measure and tape
- Can be hundreds of stands per fair and in the order of a thousand points to mark
- Often odd hours (e.g. nights)
- Very tedious and boring



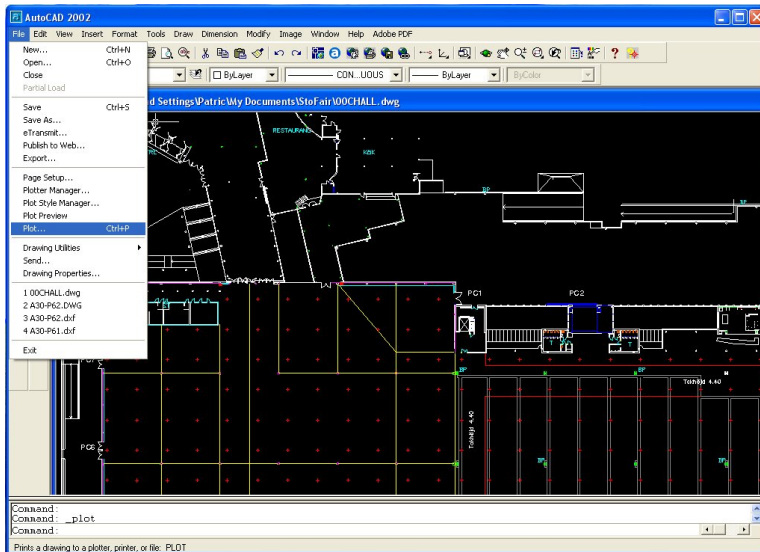
The StoFair Environment



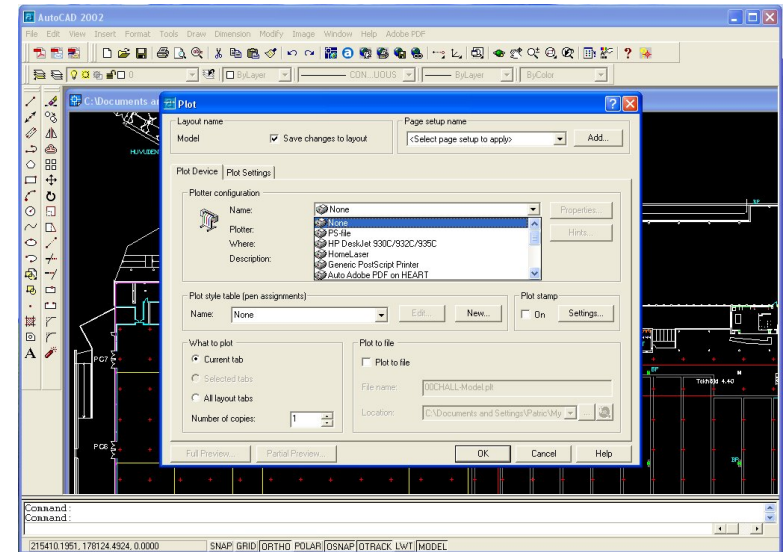
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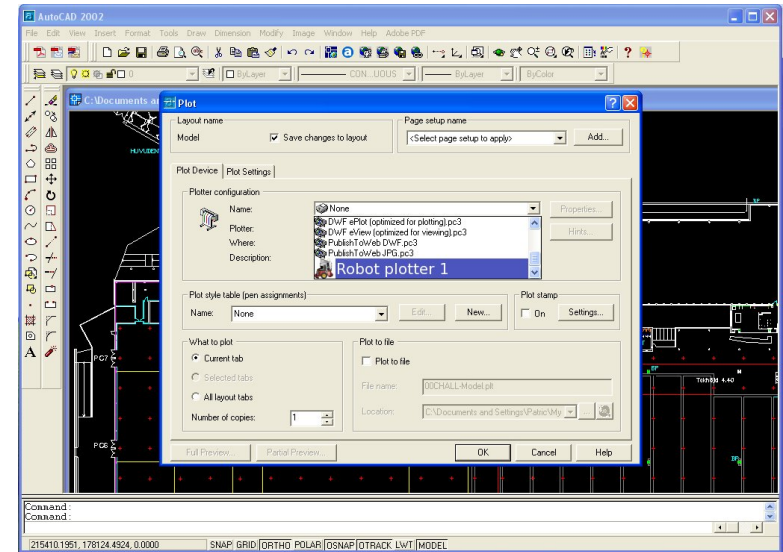
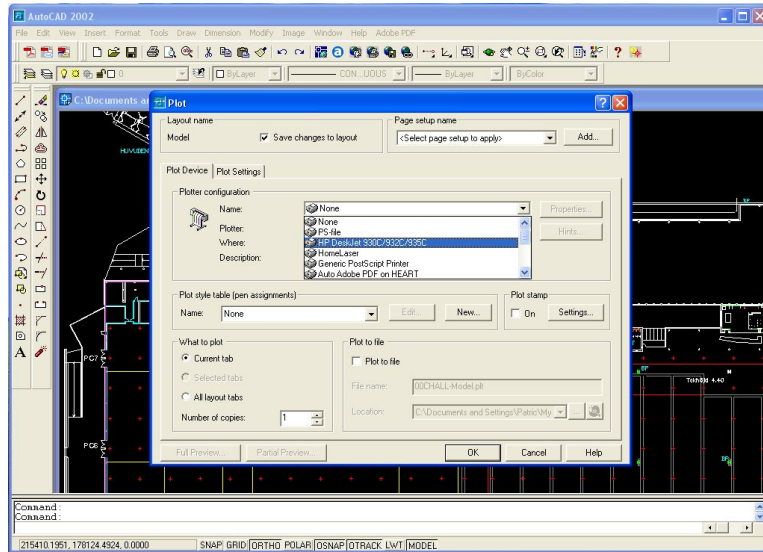
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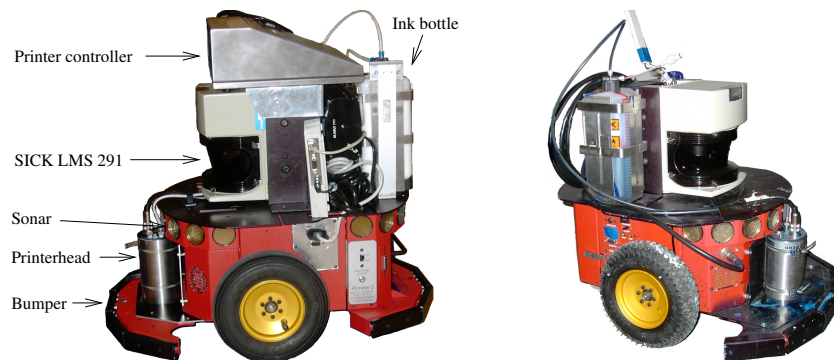
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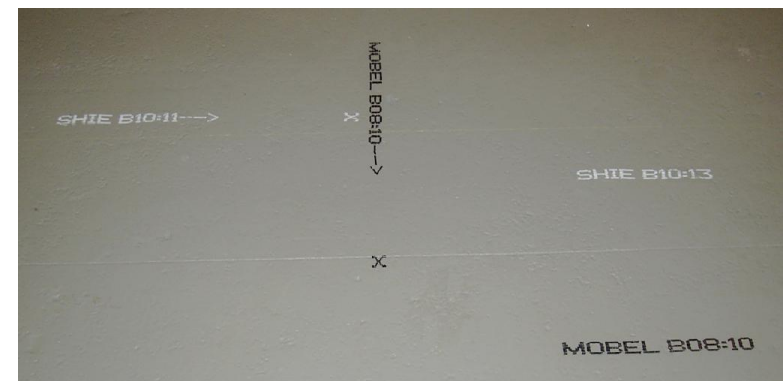
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Meet Harry Plotter and friend!



Example mark



Harry plotting

Harry following Erik

Results

- Gain in productivity
 - Before: 2 people 8h
 - Now: 1 robot + 1 operator 4h
- Been running in production since August 2003

Main components in StoFair system

- Positioning system (where is the robot)
Where am I?
- Marking device (mark on the floor)
Actuation in general. Manipulation, etc
- Obstacle avoidance (don't run into things)
Navigation
- Trajectory planning (what order to mark, "TSP")
Planning, reasoning, etc
- User interface (how to operate it)
How to communicate?

To come

- Learn more about some of the building blocks of a robot
 - means of locomotion
 - kinematics
 - sensors
 - perception
 - planning
 - navigation
 - localization
 - mapping

NOW

Form groups