Robots of the 21st Century:
What we can Expect.

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OLLI Weekend in the Rockies
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Introduction

• Dancing Robot
• who
• what
• why
Robot History

- A very short history of robots to give some perspective.
Where did the name Robot come from?

- Karel Capek, Czech playwright
- **Play:** *R.U.R. (Rossum's Universal Robots)*, 1921
- Robota in Czech means labor, forced laborer, or slave
Robotics

• The study and use of robots

• The new field of robotics raised ethical issues

• Isaac Asimov, science fiction writer first used the term robot in books

  • Runaround, a short story published in 1942 defined the “Three Laws of Robotics”

  • also in I, Robot a collection of short stories
Asimov’s Three Laws of Robotics

- A robot may not injure humanity, or, through inaction, allow humanity to come to harm.
- A robot may not injure a human being, or, through inaction, allow a human being to come to harm, unless this would violate a higher order law.
- A robot must obey orders given it by human beings, except where such orders would conflict with a higher order law.
- A robot must protect its own existence as long as such protection does not conflict with a higher order law.
A very brief history

- Walter - Turtles, 1951
- Devol invented the first programmable robot, the Universal Automation = Unimation, 1954
- Engleberger, Unimation in Ford Plant, 1960
- Shakey (SRI), a mobile robot with vision capability, computer the size of a room, 1968
- IBM 7565, cartesian coordinate robot, 1972
- Cincinnati Milicron T3, first mini-computer controlled robot, 1973
- Unimation develops PUMA (programmable universal machine) for Assembly, 1978
- Sankyo and IBM market the SCARA (selective compliant articulated arm) robot - 1979
- Cognex (maker of vision systems) founded, 1981
- GM FANUC, founded to market robots in US, 1982
A very brief history

• Seymour Papert, Mindstorms (1980) → Legos
• Sojourner, Spirit Rovers, Mars 1997
• Asimo – Honda humanoid robot, 2000
• Aibo – Roomba (2002)
DARPA

Grand & Urban Challenges

• **Grand Challenge**
  • Two competitions
    • **Part1**
    • **Part2**
  • **Urban Challenge**
Current Technology

• The Three Big Challenges
  • Perception
  • Dexterity
  • Software
Parallel (aka Delta) Robots

- Used for high speed material transfer
- Precise positioning
- ABB Delta - croissants
Lawnmowing robots

- Ireland - ad for robot mower
Aqua

- Robot Fish London Aquarium
Snakes

- SnakeBot for surgery
- Military Snakes
Crawlers

- RiSE BD
Personal transportation

• Toyota
Rat brains, bugs, and Monkeys

• **Cyborg Bugs**

• **Monkey with Robot arm**

• **Gordon**
Parallel Parking Car

- Lexus
NASA

- Athlete
- Robonaut
- stereovision
- R2 from discoverynews
Walkers

- Asimo
- ToyotaViolin
- Nao
- LittleDog
- Petman
- BicycleRidingRobot
Exoskeletons

- Sarcos
- Berkeley Bonics
4 legged walkers

- Big Dog
- Big Dog2
Hands and Prosthetics

- Barrett Hand
- Shadow Hand
- DARPA
  - Bionic arm, hand movement
  - Claudia’s new arm
Surgery

• De Vinci

• Doing origami
The Future

• Helping the Elderly
• Swarms
• Agriculture
• Medical
• Military
• Humanoids
• Bionic People
Help for the elderly

• 21
  • 4.8' x 2' (1.5 m tall x .75 m wide)
  • omni-directional
  • 12 ultrasonics and 6-axis force sensor
  • Hands
    • 4 fingers
  • Arm
  • Platform
  • Head
  • Due out in 2015
    • $110,000 to $221,000
  • Video
Swarms & Transformers

- robotSoccer

- SelfAssemblyCornell

- SelfAssemblingRobots
War

- Air
  - Predator MQ-1 USAF-MQ-1-predator
  - Global Hawk
    - Approved to file its own flight plan
- Land
  - 710 Warrior, Talon
  - Crusher
- Future Combat Systems
  - Part1 Part2 Crusher Part3 Helicopters Part4 WhiteSandsDemo
  - CMU Crusher
  - Iranian Triangle Rescue robot
  - Bear the soldier carrier
- Some "interesting" new projects
  - Proper flying car
  - Military App store
  - Ghost-frigates
Humanoids

- FemBots
- Actroids
  - Kokoro Actroid DER2 at Kennedy Center
- Hanson Robotics
- Eva and Albert
- Dental Student Training - Pain girl
- Domo - stereovision and dual-arm manipulation
- MDS (Mobile, Dexterious and Social)
- Hi I'm NEXI
Robot Surgery

- Da Vinci
- DARPA Traumapod 2025
Bionic People

- Human versus Machine Intelligence
What will it take to get to the future?

- Natural language
- Dexterity
- Intelligence
  - Perception
  - Synergistic Analysis
- Power
- Software Integration
- Systems Integration