ECGR4161/5196 – June 21, 2011

YouTube Videos:

- PCB Manufacture #1: http://www.youtube.com/watch?v=HFM4vXDjw9Q
- PCB Manufacture #2: http://www.youtube.com/watch?v=H-_tibD0qjw
- Kids doing robotics! http://www.youtube.com/watch?v=1bVcQBpKnd4

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Read Chapter 3

Exam 1 contents:

- Labs 0, 1, 2, 3
- Homework 1, 2, 3
- Book Chapters 1, 2, &3
- All class notes

Timber Jack Hexapod

-A six-legged logging machine intended to reduce logging roads and increase access to steep terrain.

- While the vehicle navigation and cutting arm are directed by a human operator, the legs are autonomous.

http://i.ytimg.com/vi/CgBNjdwYdvE/2.jpg

http://www.youtube.com/watch?v=CgBNjdwYdvE Length 0:15

-New Horizon Media's promo video on the Plustech prototype Walking Machine used in to fell lumber.

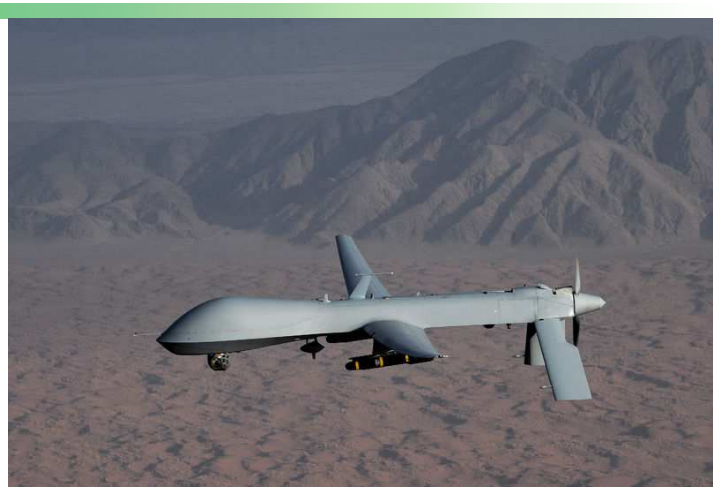
-Plustech is now Timberjack, a division of John Deere.

http://i3.ytimg.com/vi/CD2V8GFqk_Y/0.jpg

http://www.youtube.com/watch?v=CD2V8GFqk_Y Length 1:32

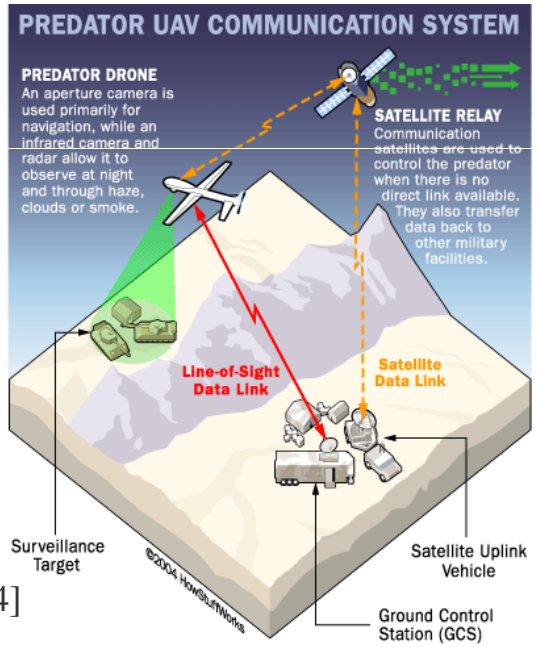
Unmanned Aerial Vehicles (UAV's)

- Over 10,000 unmanned systems in service
- An aerial vehicle that is either remote control or autonomous (mixed)
- GPS/INS
- Camera System – zoom, IR
- Communications
- Weapons
- Lifting the fog of war



Predator Drone in flight [2]

[4]



Predator Comm Systems [3]

Raven Drone [5]

[1] "Wired for War", P.W. Singer.
[2] http://en.wikipedia.org/wiki/General_Atomics_MQ-1_Predator
[3] http://science.howstuffworks.com/predator6.htm
[4] http://gizmodo.com/5673520/military-tactical-ipad-app-looks-like-a-real-life-starcraft-ii
[5] http://www.modelairplanenews.com/blog/2010/01/20/uavs-in-action/

MAVs – Micro Aerial Vehicles

- 15 cm wingspan max
- weight approx. under 20 grams
- NAVs underway (7.5 cm)
  (Yeah right DARPA)

- Fixed wing (gliders, planes, etc.)
- Rotary wing (helicopter, autogyro, etc)
- Flapping wing (ornithopter)

- Flapping wing insects are the future
- Harness mechanical power to reenergize

- Delfly Micro (3 gm, smallest with camera)
- SFD Lab (8 gm, smallest auton. flight)
- Harvard (3 cm ornithopter, wire powered)

Major Issue

- **Weight** (battery, transmission, on-board devices, etc)

References:

http://en.wikipedia.org/wiki/Micro_air_vehicle

http://www.youtube.com/watch?v=L17Ox4FQTkM

Surgical Robot : Da Vinci Surgical System

Increased Dexterity, Precision, Control, Minimally Invasive

3D, High definition vision system, 10X magnification
Bright crisp high resolution image

Endo-Wrist movement with 7 degrees of freedom
Reduces surgeons hand tremors

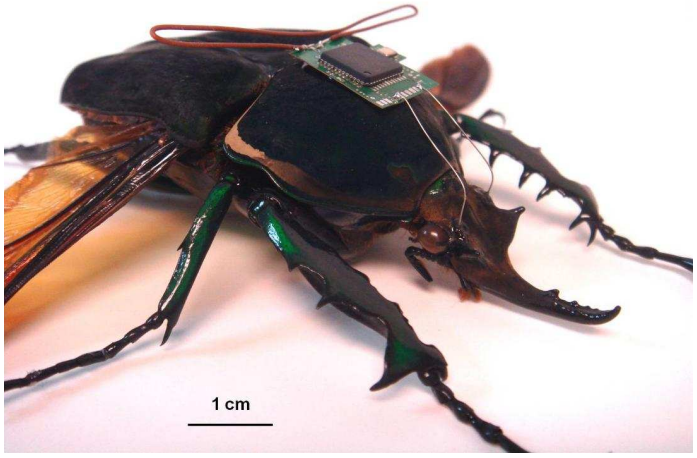
Ergonomic design – Surgeon

Reference - http://www.intuitivesurgical.com/products/davinci_surgical_system/

Hybrid Insect Micro Electromechanical Systems

- Electronic payloads attached during metamorphosis
  - Late stage tissue development interfaces with electronics
  - Control over movement and sensors
- Benefits of HIMEMS
  - Uses natures efficiency to outperform manmade microrobots
  - Can be used as a remote autonomous sensor
  - Can be directly controlled

HIMEM Moth

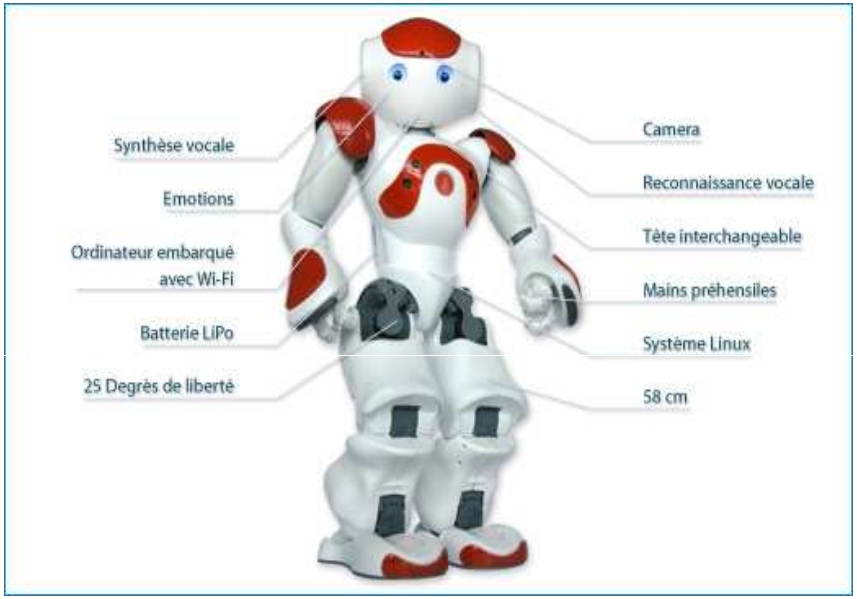


"Hybrid Insect Micro Electromechanical Systems (HI-MEMS)." *Defense Advanced Research Projects Agency*. Web. 21 June 2011. <http://www.darpa.mil/Our_Work/MTO/Programs/Hybrid_Insect_Micro_Electromechanical_Systems_(HI-MEMS).aspx>.

NAO Robotics Platform

The Nao is developed by Aldebaran Robotics. The Robo-cup Edition has 21 (DOF), while the Academics Edition has 25 DOF.

- **GEODE 500Mhz CPU**
- **256 MB SDRAM**
- **2 GB Flash Memory**
- **Software Suite + SDK to program NAO**
- **2 cameras**
- **4 microphones**
- **8 Force Sensitive Resistors**
- **11 Tactile sensors**
- **2 Infrared Sensors**



NAO has a whole range of sensors to extract information from its environment. With its 2 cameras NAO can track, learn and recognize images, landmarks and faces. With its 4 microphones NAO can track sounds and recognize words in 6 different languages.
http://m.youtube.com/#/watch?desktop_uri=http%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D4t1NWH6G1f0&v=4t1NWH6G1f0&gl=US

[1] Wikipedia 2011, June 20. NAO (Robot) [Online] http://en.wikipedia.org/wiki/Nao_(robot)
[2] Anh Tran, 2011, June 2, NAO Robotics Platform Demo [online] [mailto:atran@aldebaran-robotics.com]

Three Axis Printer (Rapid Prototype)

Create a 3-D model of your object in a CAD program

AutoCAD/Pro-E or any other preferred program, tears apart the 3-D model into layers fractions of a millimeter thick

Separate materials are sometimes used, as a support frame for intricate designs

Fed by either metal or a polyurethane

Example, of a three axis printer at work

1) "AMS Genesis Turbo Kit First Rapid Prototype for Test Fitment. | AMSPerformance.com." *AMSPerformance.com Blog*. Web. 21 June 2011. <http://blog.amsperformance.com/2009/04/10/ams-genesis-turbo-kit-first-rapid-prototype-for-test-fitment/>.

2) "We Have Just Received Our Roland 3-axis CNC Machine | Canard Design." *Product Design, Development, Prototyping and Engineering*. Web. 21 June 2011. <http://www.canard-design.co.uk/product-design/product-design/we-have-just-received-our-roland-3-axis-cnc-machine/>.

Robot Assisted Search and Rescue

- Designed for the purpose of aiding rescue workers
  - Mining accidents, urban disasters, hostage situations, explosions, etc.
- Advantages: Reduced personnel, reduced fatigue and access to unreachable areas
- Disadvantages? 14k-80k price tag,

100 ft remote controlled, communication glitches

- T-53 Enryu: Fukushima plant
  - 5 tons, 9 foot tall
  - Two arms, six joints, hoists 440 lbs
  - Operated directly or remotely

http://news.cnet.com/8301-17938_105-20056667-1.html

http://www.sptimes.com/2003/03/02/Floridian/Robots_to_the_rescue.shtml

Industrial Applications – Remote Inspection

Mobile Inspection Robots are typically employed for safety critical or high value systems which are difficult or dangerous for human inspectors to access.

Recent Fame:

- Fukushima Nuclear Disaster
- Gulf Oil Spill
- IEDs in Iraq and Afghanistan

Typical Applications:

- Chemical or Radioactive Hazards
- Underwater Environments
- Confined Spaces (pipes, tanks)
- High Voltage Electrical
- Battlefield

[1] http://www.hydroquebec.com/...
Linescout by HydroQuebec inspecting HV power...
Oceaneering ROVs working o...
[4] http://www.robotshop.com/blog/tag/hydro-queb...
[2] www.nola.com/news/gulf-oil-spill/index.ssf/2010/07/undersea_...

Jenoptik Votan Laser Cutting

Turn-key solution for
2D and 3D laser
Beam cutting of metals.
Can handle CO_2 as well
As solid state laser beams.
Has integrated laser beam
Directly on the robot arm

Applications

Car & Truck Manufacturing
General Metal Construction
Materials Manufacturing

Specifications

CO_2 laser up to 5kW
Fiber laser up to 2kW
.51 meter reach
.1mm accuracy

Jeffrey Skelnik ECGR 5196

http://www.beijing-essen-welding.german-pavilion.com/gp/bew11/exhibitors/dateien/05_JO-AT_01.11_2025.5_EN-20_Jahre.pdf
http://www.youtube.com/watch?v=9ZvcvppsdqE

The Use of Robots in Electronics Card Assembly. Link to robotic assembly [3] . http://video.google.com/videoplay?docid=3097498639904880738#

Figure 1 manual assembly from [1]

Figure 2 card in test by Nabila Bousaba 2002

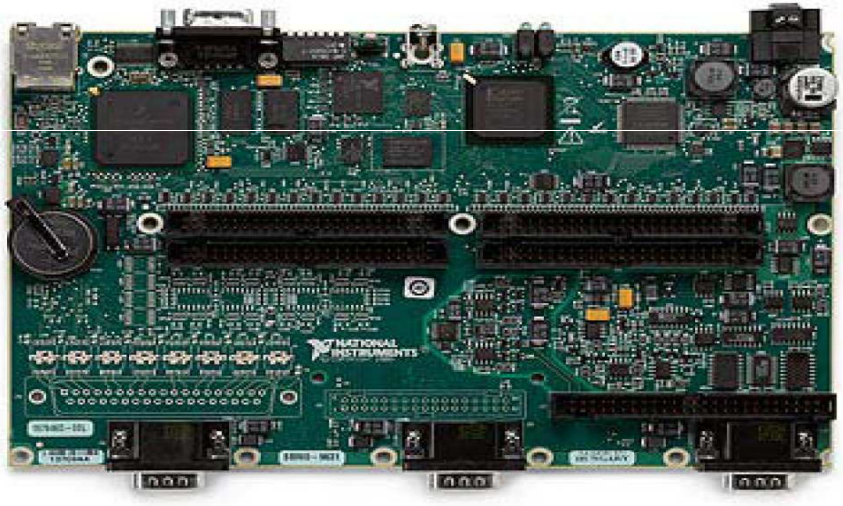


Figure 3 NI sbRIO-9631 board from [2]

References:

[1] http://www.mbdaps.com/manufacturing-solutions/electronics-and-circuit-card-assembly

[2] http://sine.ni.com/nips/cds/view/p/lang/en/nid/205894