



Rapid Prototyping of Small Robots



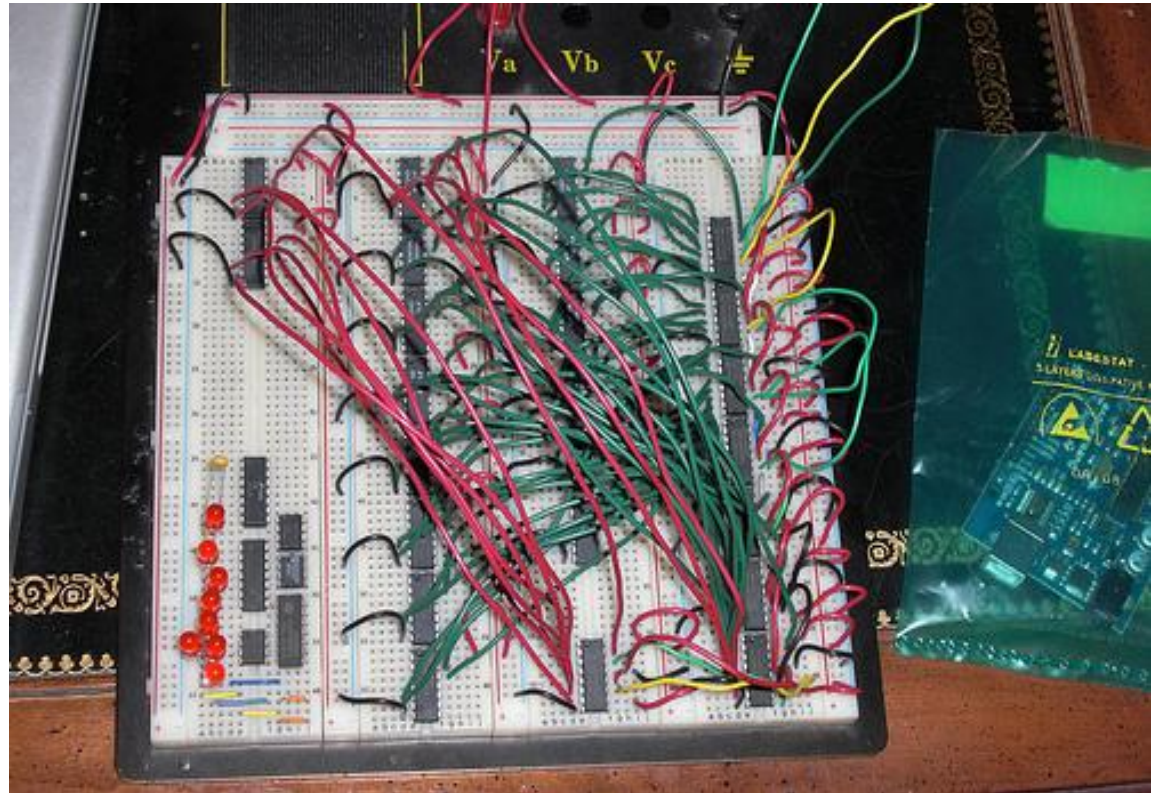
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Why Prototype a Robot?

- Design Specs
- Mechanical Specs
- Testing Concepts





Control Techniques

- Human Powered
- Radio Controlled
- Computer Controlled
- Computer Simulated (3D CAD)



Radio Controlled

- Model Airplane Receivers and Controllers
- Hack a cheap toy
- Control from a PC via IR or RF

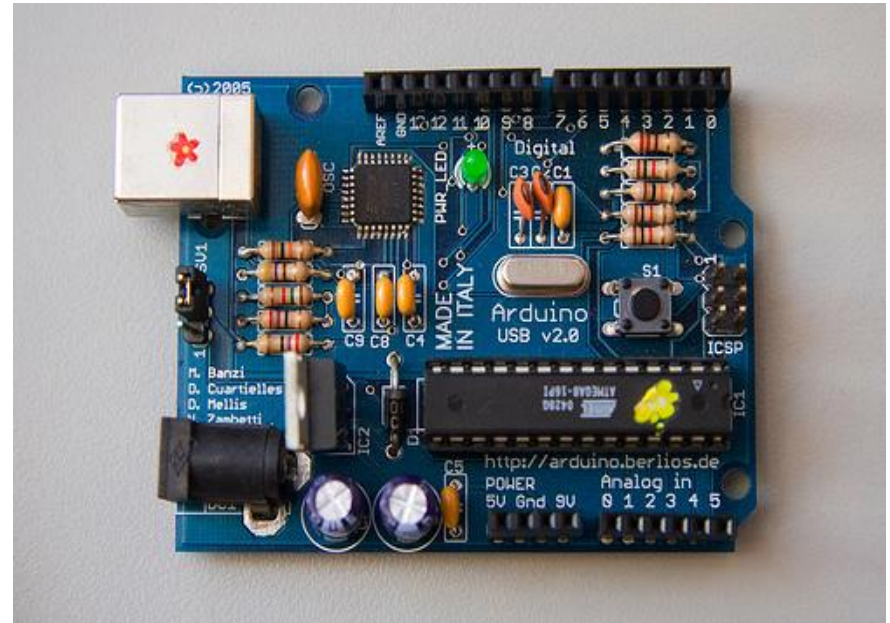
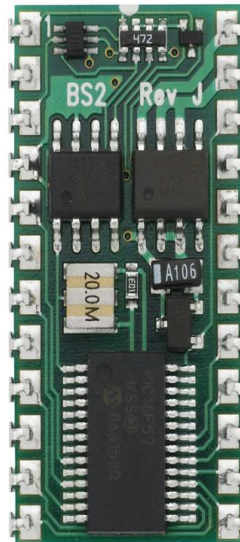




Computer Controlled

“Sketching in Hardware”

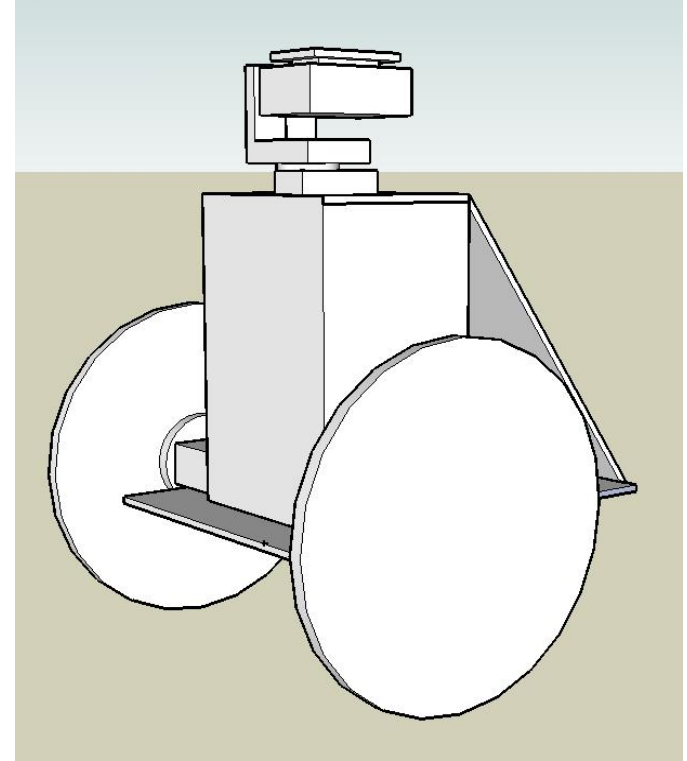
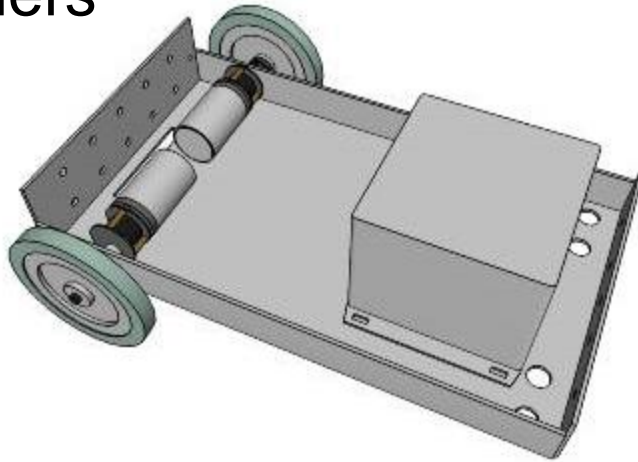
- BASIC Stamp
- Arduino
- PicAXE





Computer Simulation

- Google Sketchup
- Solidworks
- Pro/Engineer
- AutoCAD
- Others





Power

- Tethered
- Rechargeable (NiMH, Lithium, NiCad)
- Usually 4.5v – 12v
- Can use RC car batteries instead of buying new ones
- onlybatteries.com





Sensors

- Microswitches
- Photosensors
- Pyroelectric
- Flex sensors
- Force-sensing
- Piezoelectric
- Sonar
- Tilt
- Encoders
- etc.

Where to get sensors?

- Futurlec (gas sensors)
- Sparkfun
- Acroname
- Pololu



Materials

- Metals
- Plastic
- Pre-built
- Recycled
- Inventables and other similar companies





Metals

- Aluminum
- Brass rods
- Steel
- Anything laying around
(e.g. Coat hangers, Thick gauge wire)



Plastics

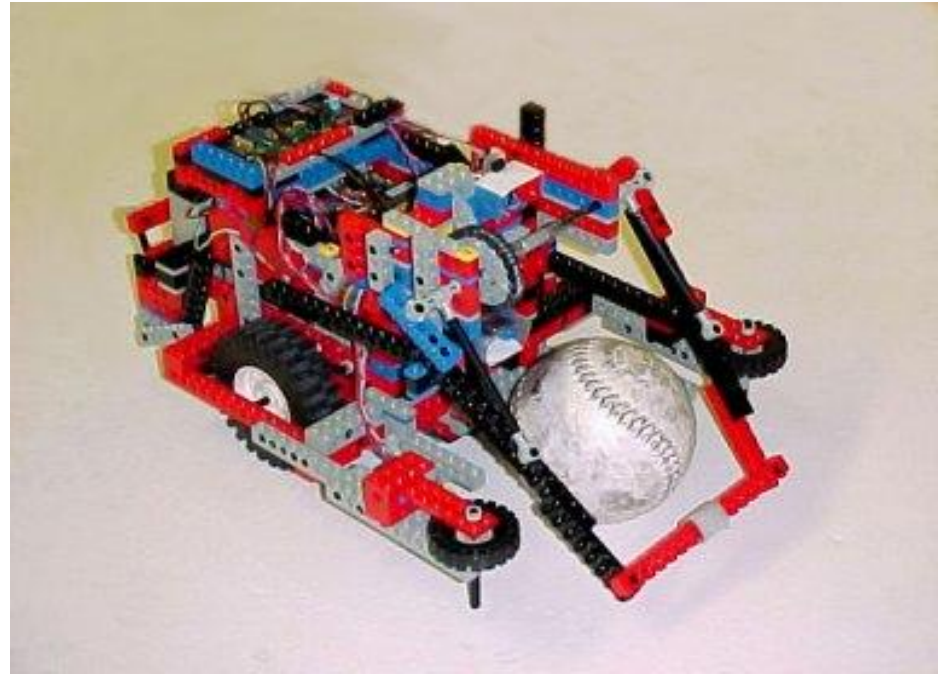
- Acrylic
- Polycarbonate
- Low heat thermoplastics
(e.g. “Shapelock”, “Friendly Plastic”, “Sintra”, etc.)
- Recycle





Pre-built

- Legos
- Knex
- Meccano (Erector set)
- Vex Robotics





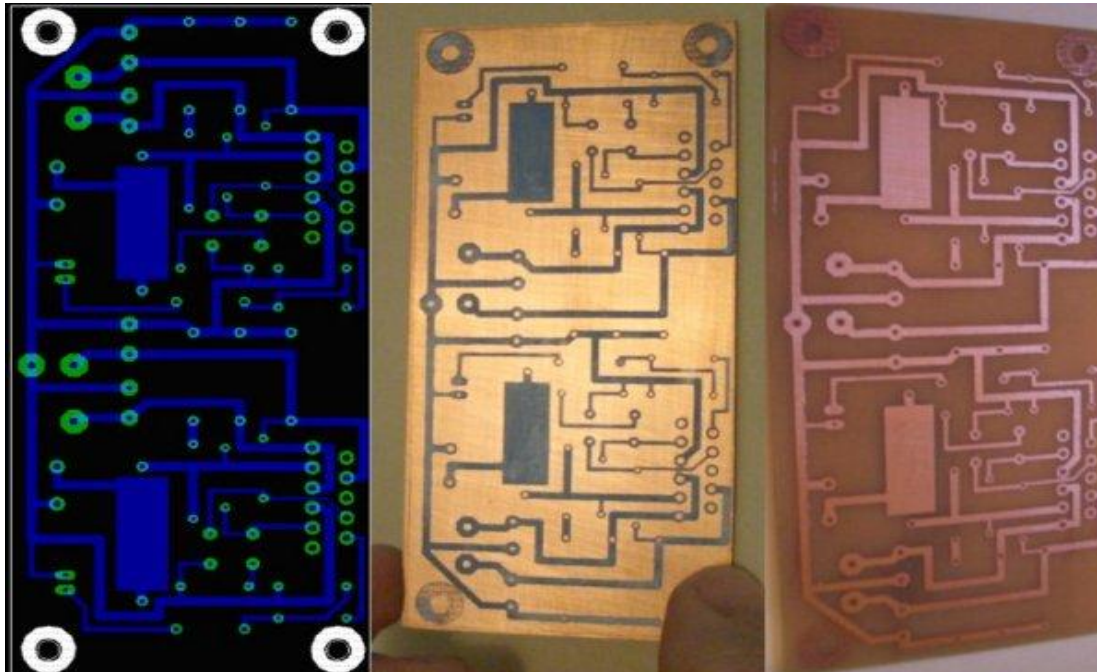
Motors

- Servomotors:
Buy normal servos for cheap, then hack them for continuous rotation
- Motor Driver and regular DC motors:
Cheap electric screwdriver
- Stepper motors



Circuitry and PCBs

- Breadboards
- In-house PCB fabrication
- Board house fabrication





Cited Works

- Paper: Rapid Prototyping of Small Robots <http://www.cs.cmu.edu/~illah/PAPERS/pprk.pdf>
- Title slide image <http://www.flickr.com/photos/artbots/143316769/in/set-72157600106411757/>
- Messy Breadboard <http://flickr.com/photos/dan-richert/3120035253/>
- Robot #1
- <http://sketchup.google.com/3dwarehouse/details?mid=520ee40d97fc66afd4553ca372b56cc4>
- Robot #2 <http://projectbloc.com/seniorproject/robot-base/>
- Battery Pack
- <http://www.onlybatteries.com/showitem.asp?ItemID=14310.55&cat1=12&uid=1010>
- Inventables Kiosk http://www.inventables.com/Product/Kiosk_Group_2.jpg
- Lego Robot <http://www.honary.co.uk/MyPublications/tabid/136/Default.aspx>
- Meccano Set
- <http://www.theplayground.co.nz/pages/list.phtml?s=42F949DA1204977896698&category=B9965>
- PCB etch process http://mjtronics.com/Projects/PCB/PCB_BoardSteps.jpg