

So, you want to build a robot...

by Steven Kaehler © 2006



This should be easy....NOT!

- Why do I want to do this?
- Where do I begin?
- What should it look like?
- How big (or small) should it be?
- What should it do?
- Will it move or be stationary?
- Will it have a “brain”?
- What must it be able to sense?
- What is possible for me today?
- Questions & Answers

Why do I want to do this?

- Educational experience
- Hobby, fun, enjoyment
- Creative outlet
- Technical challenge
- Win contests -- \$\$\$\$
- Win a bet (“betcha can’t build a robot.”)
- You’re a little crazy....?

Where do I begin?

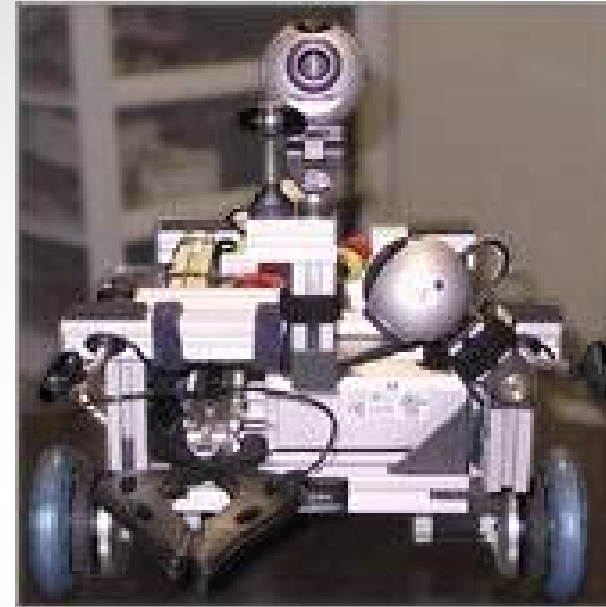
- Seattle Robotics Society
- Come to the monthly meetings
- Contribute to the collective experience
- Robothon Contests & Events
- F.I.R.S.T. Events
- Talk to people; Ask questions
- SRS website & World-wide listserver

Now, where do I really begin?

Commercial-Off-The-Shelf (COTS)

- Sony AIBO
- LEGO Mindstorm (brick-to-brick)
- Evolution Robotics (laptop controlled)
- Roomba (self-guided but dumb)
- Lynxmotion, Parallax, RobotStore
- Kits (e.g. Hobby Engineering)

Evolution Robotics & AIBO



Roomba & Scooba - Sharper Image

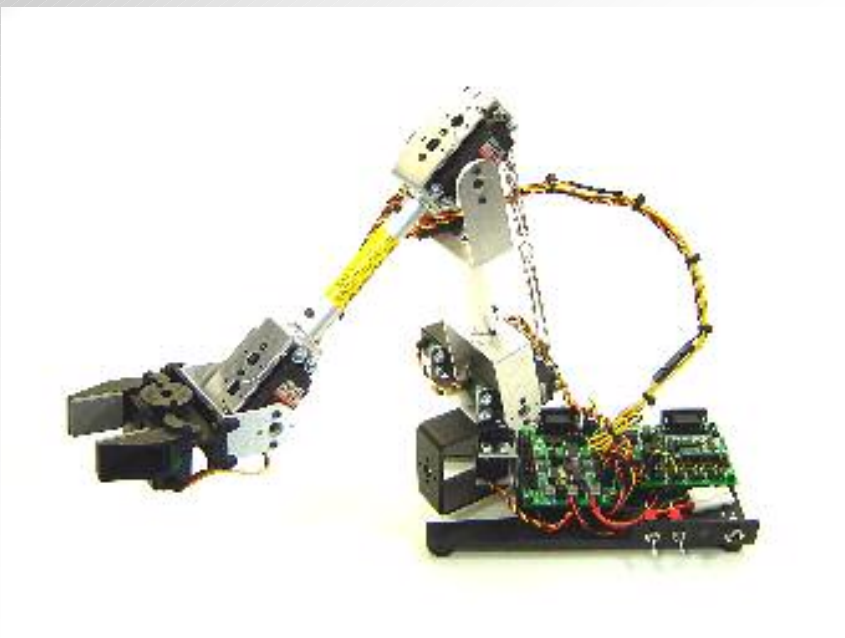
For all the reasons you hate to mop...



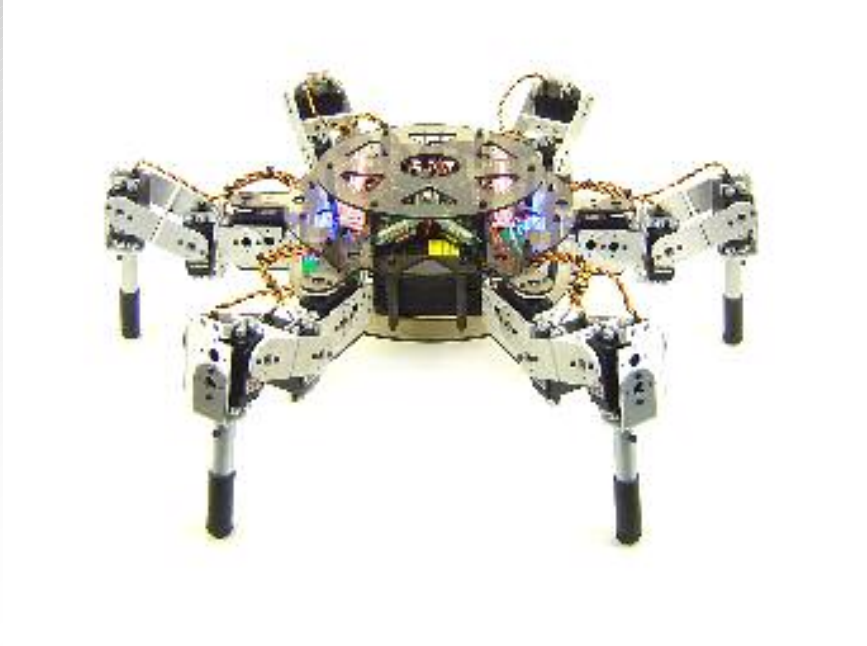
4 cleaning steps in 1 pass



Pictures from The Sharper Image website (<http://www.sharperimage.com>)

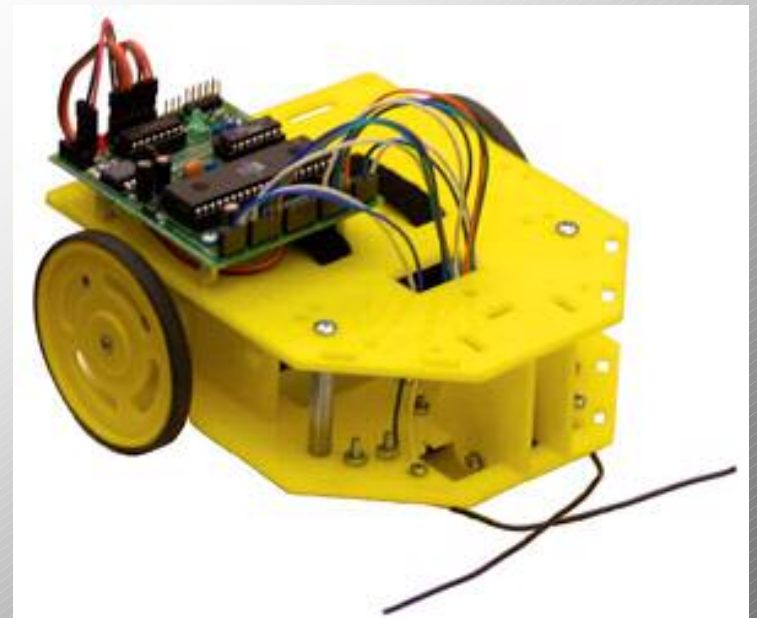


Lynxmotion Kits - www.lynxmotion.com



Where *Else* could I begin?

- Copy others
- Build from scratch
- Kit-bash an RC model or other kit
- Kit-bash something never intended
- F.I.R.S.T. robot parts
- VEX Robotics parts
- SRS Workshop Robot



Scratch Build or Kit-Bash

- Copy someone who's succeeded
- Make similar mods to a store-bought toy
- Use ordinary items in extraordinary ways
- Build scratch-designed machines
- Use “standard motors & controllers”
- Start with a “basic kit”



Top left, center, & right:
Karl Lunt's "Tacklebot"

Left: Gary Teachout's
"LC" fire fighter

Right: Ted Griebeling's
"Macbeth" fire fighter



VEX Robotics System

THE MAKINGS OF GENIUS, PIECE BY PIECE

With over 500 parts, the Vex Robotics Starter Kit lets you create virtually any robotic device your mind can conceive. Simply roll over a part to find out what it is.

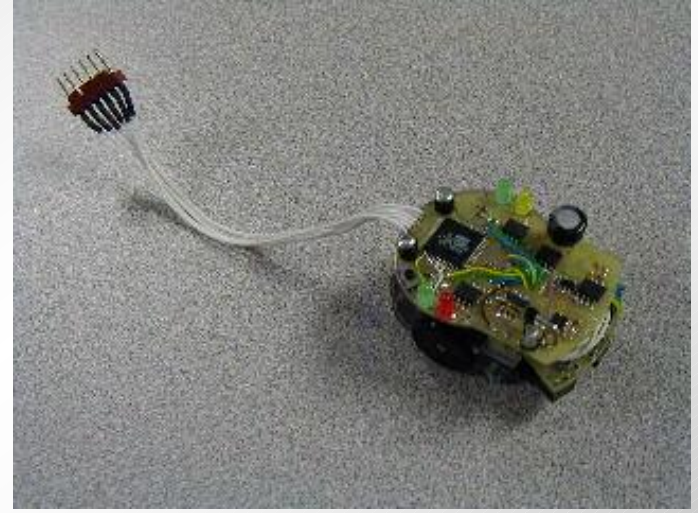
STARTER KIT | **BUY NOW**



Screen image from the
Vex Robotics website at
(<http://www.vexrobotics.com>)

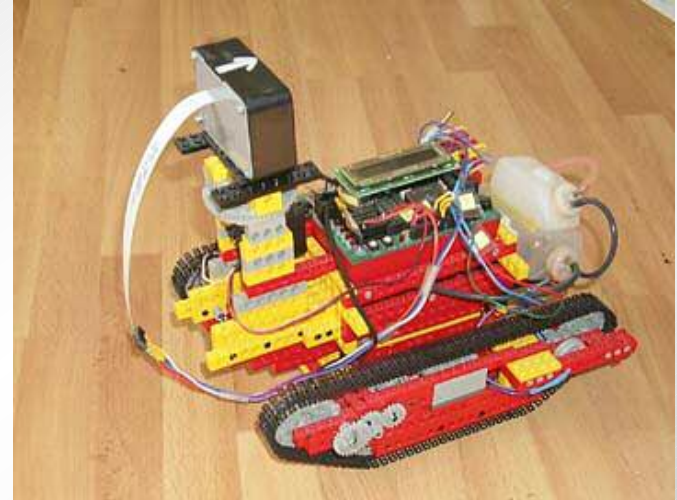
How Big (or small) Should it be?

- Depends on what does
- Where must it be able to go
- M+M'bot was really small
- Micro-sumos fit in 1" cube (nanos are smaller)
- F.I.R.S.T. robots can be a dozen feet tall
- Sumos 10 or 20 or more centimeters
- Robo-Magellan's are 2-3 ft square



What should it do?

- Competition
- Companionship
- Technical challenge
- Hobby expression
- Security, monitoring, data collection
- Mapping, exploration
- Tour guide, amusement
- Demonstration of what's possible



Picture from Jim Wright's website – Fire Fighter

Will it move or be stationary?

- Colossus: The Forbin Project (“Guardian”)
- Fixed robot are not limited
- Make your house into a robot (X10)
- Mobile robots need power from somewhere
- Portable power sources run down
- Battery technology can improve a lot

What will it look like?

- Sleek, smooth body, chrome-plated (R2D2)
- Chunky, boxy, stubby, functional
- Lots of wires, lights, mechanisms, etc.
- Natural - like human, insect, or animal
- Vehicular - wheels, treads, propellers
- Toy-like (e.g. Robosaipien, Bionicles, etc.)
- Simple functional machine (industrial arm)

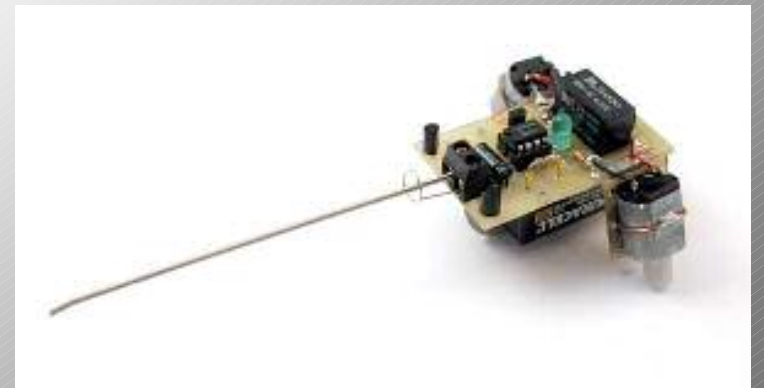


Will it have a brain?

- “If I only had a brain....”
- Switches, bumpers, analog sensors
- Simple logical function blocks
- Nervous Networks
- Microcontrollers
- Mini computers
- PDAs
- Laptops
- Remote, off-board wireless link to ??
- Remote Control (human)

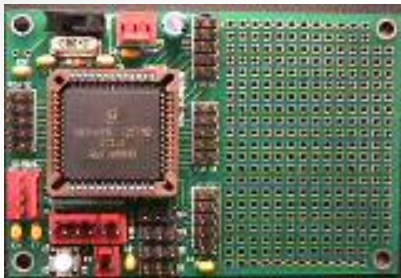
“Brainless” Controllers

- B.E.A.M. Technology
- Simple switch logic
- Analog sensors
- Digital logic circuits
- “Nervous Networks”



Microcontrollers

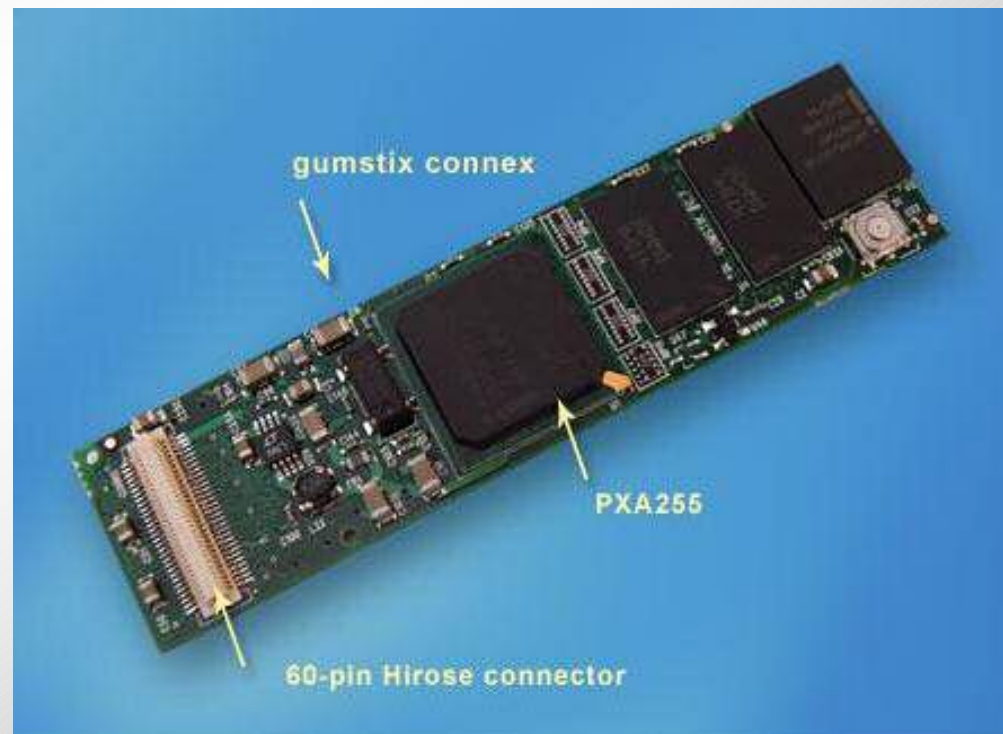
- BotBoard+
- 68HC12
- MRM
- BASIC Stamp
- AVR Robot Controller (ARC)
- Many others



Pictures from <http://www.kevinro.com>, <http://www.parallax.com>, and <http://www.barello.net> left to right respectively

Minicontrollers & PDAs

- Gumstix



Portable PCs



- Laptops
- Pocket PCs
- Mini desktop PCs on UPS
- Transportable computers

Off-board wireless links

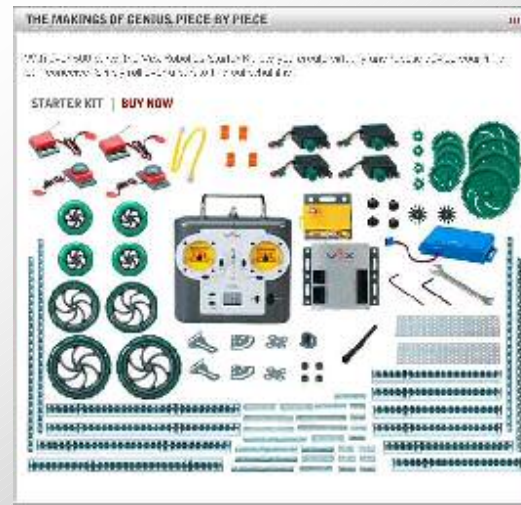
- Mainframe controllers
- Networked PCs
- Unlimited storage capacity
- No power limitations
- Robot(s) can be simple, small
- Robot(s) must stay within range of network
- Potential for “swarm” exploration/systems

Remote Control

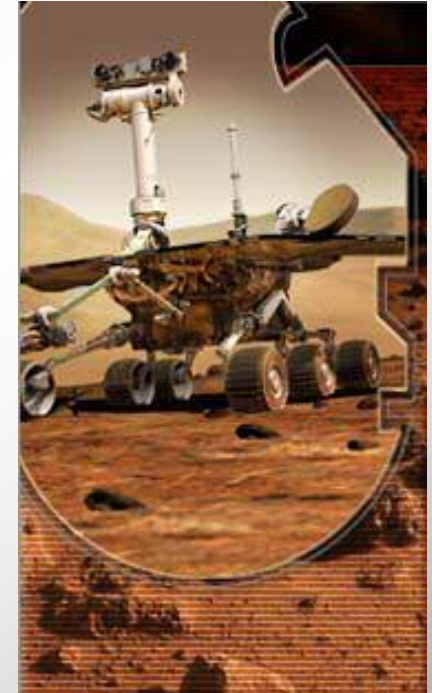
- Used in combat robotics
- Used in F.I.R.S.T. competitions
- Robot “brain” is mainly “human”
- Not completely autonomous
- Mars Rovers



<http://www.westeralliedrobotics.org>



<http://www.vexrobotics.com>



<http://www.space.com/marsrover/>



Sensors

- Bumpers, feelers, touch & pressure sensors
- Heat, flame, & light sensors
- Sound sensors (audible & ultrasonic)
- Range & proximity (IR, ultrasonic, laser, etc.)
- Encoders (rotary & linear)
- GPS, rate gyros, accelerometers
- Other navigational sensors & systems
- Vision acquisition & processing systems
- Chemical & smoke detectors

What is possible for me today?

- How big is your budget?
- How much time do you have for this?
- How skilled are you in:
 - Mechanics?
 - Electronics? (design & fabrication)
 - Programming? (design & generation)
 - System Integration?
- How determined are you to succeed?
- How big are your dreams?

A Few Internet Links

<http://www.LynxMotion.com>

<http://world.honda.com/ASIMO/>

<http://www.robosapienonline.com/>

<http://www.robots.epson.com/>

<http://www.sony.net/Products/aibo/>

<http://www.LegoMindstorms.com>

<http://www.lugnet.com/robotics/>

<http://www.evolution.com>

<http://www.HobbyEngineering.com>

<http://www.solarbotics.com>

<http://www.gumstix.com>

<http://www.atmel.com>

<http://www.SharperImage.com> (search for “roomba” or “scooba”)

<http://www.SeattleRobotics.org/WorkshopRobot/index.php>

<http://www.rybots.com>

<http://www.smallpc.com/>

<http://www.dell.com>

<http://www.thaddeus.com/>

<http://www.SeattleRobotics.org/>

<http://www.robothon.org/>

<http://www.barello.net>

<http://www.kevinro.com>

<http://www.hobbytron.com/>

<http://www.nubotics.com/>

<http://www.WesternAlliedRobotics.org>

<http://www.space.com/marsrover/>

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Questions & Answers

Possible Future Presentation Topics

Hardware

- Controllers
- Sensors
- Power Sources
- Drive Systems
- Walking Robots
- Navigation
- Vision

Software

- Programming
- S/W Dev. Tools
- S/W Strategies
- General Control
- Behavioral Logic
- Self-Navigation
- Self-Learning