

# 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

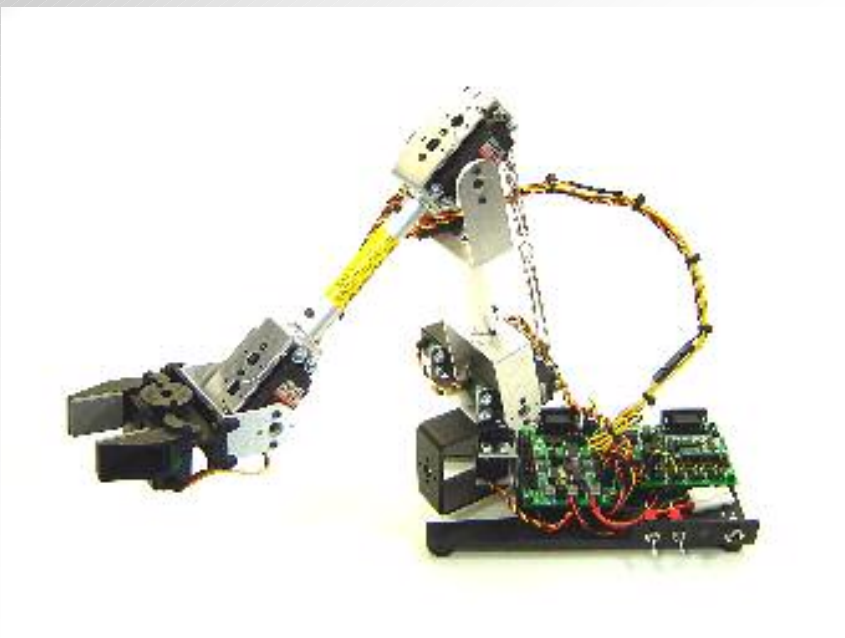
For all the reasons you hate to mop...



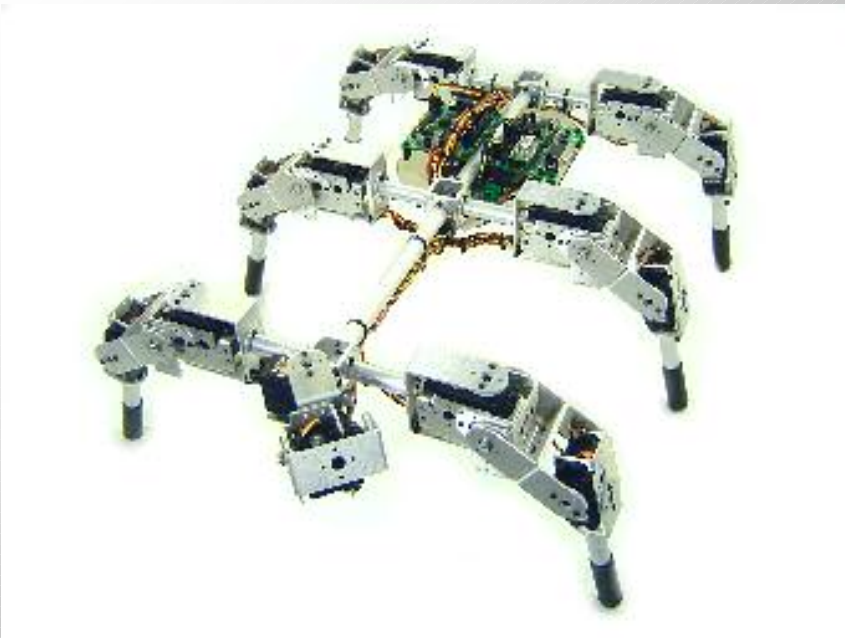
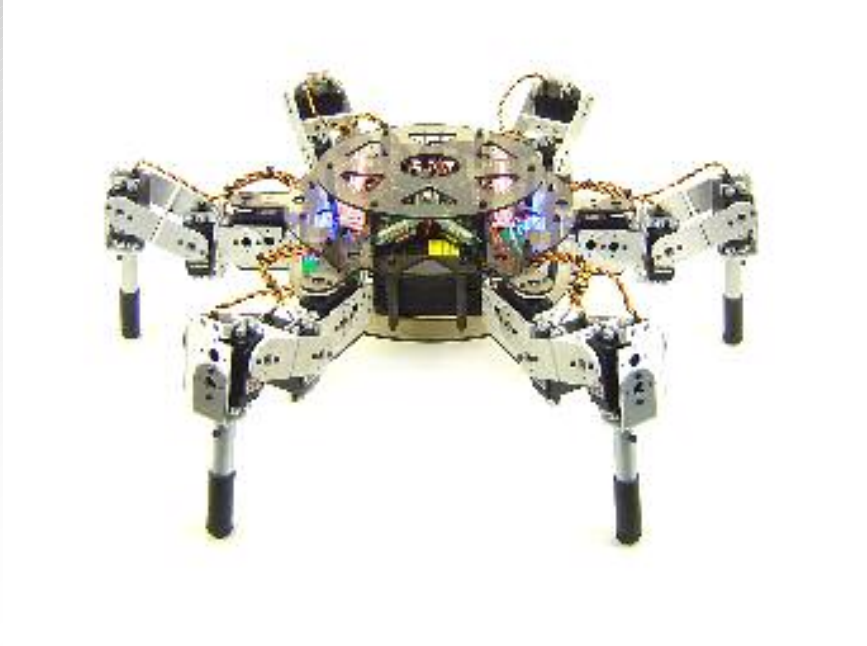
4 cleaning steps in 1 pass



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

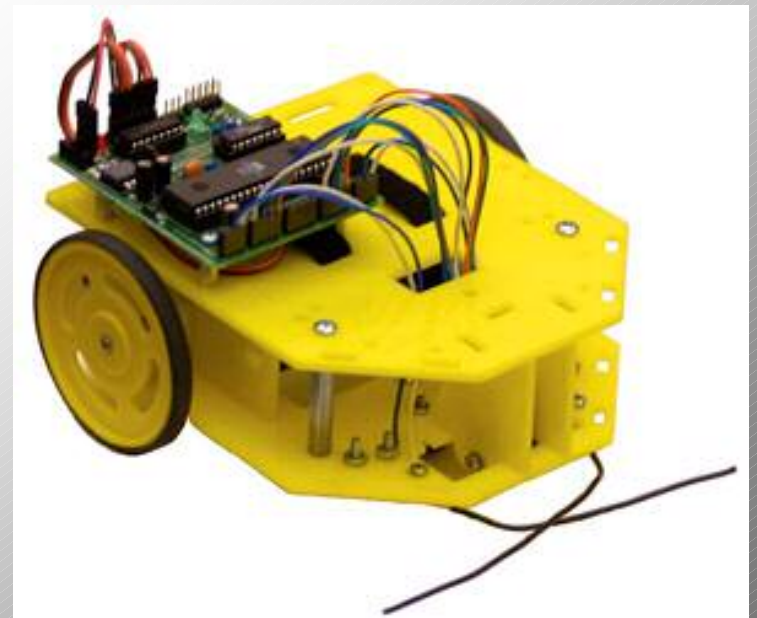


Lynxmotion Kits - [www.lynxmotion.com](http://www.lynxmotion.com)



# 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.

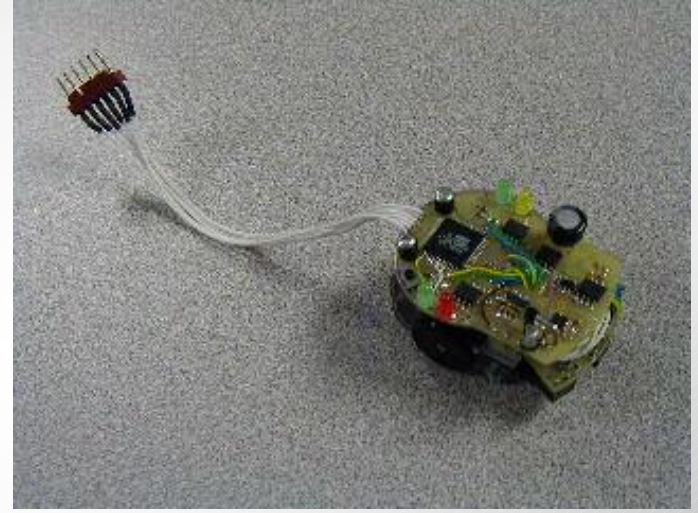
**STARTER KIT | BUY NOW**



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

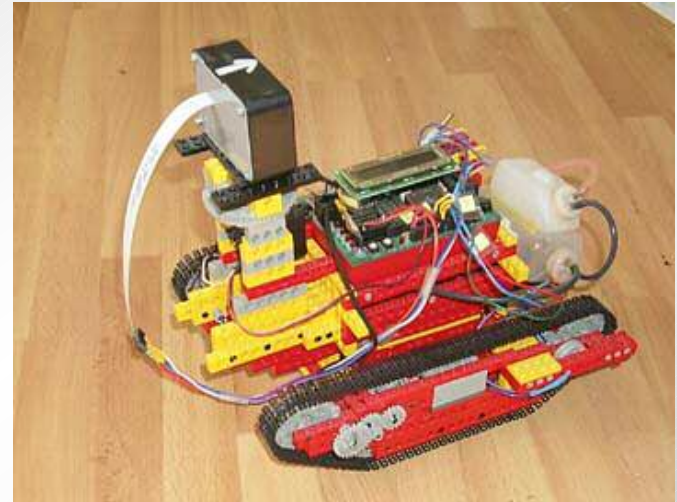
# How Big (or small) Should it be?

- 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)

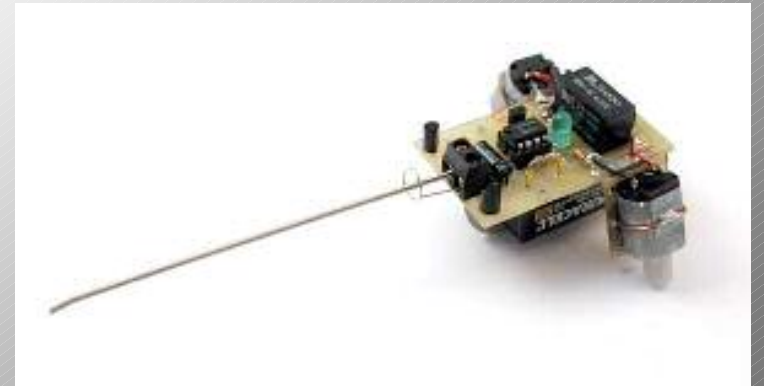


# Will it have a brain?

- “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)

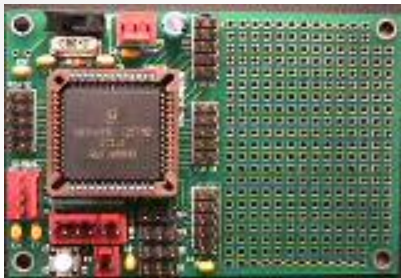
# “Brainless” Controllers

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



# Microcontrollers

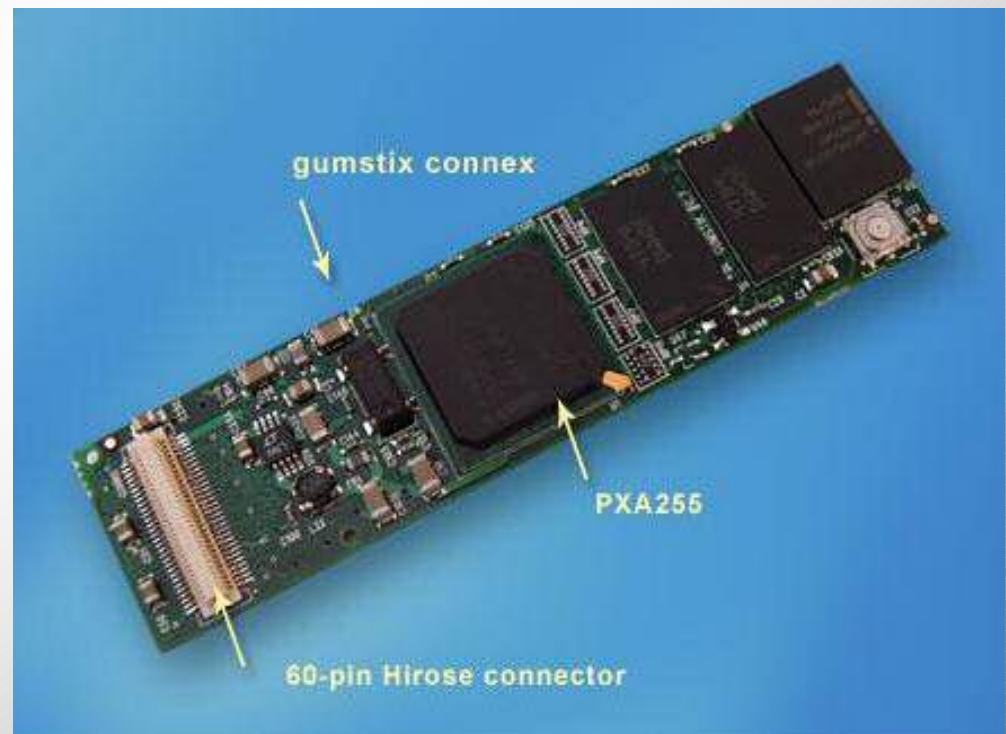
- BotBoard+
- 68HC12
- MRM
- BASIC Stamp
- AVR Robot Controller (ARC)
- Many others



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