

Biology was Robotics Before it was Cool.

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Nature had all of the good ideas first.

When I was a young

When I was a young lady I didn't
want to be a software engineer...

I actually wanted to be a biomedical
engineer.

Or some other kind of kick-ass
scientist.

My First Week at University of Michigan



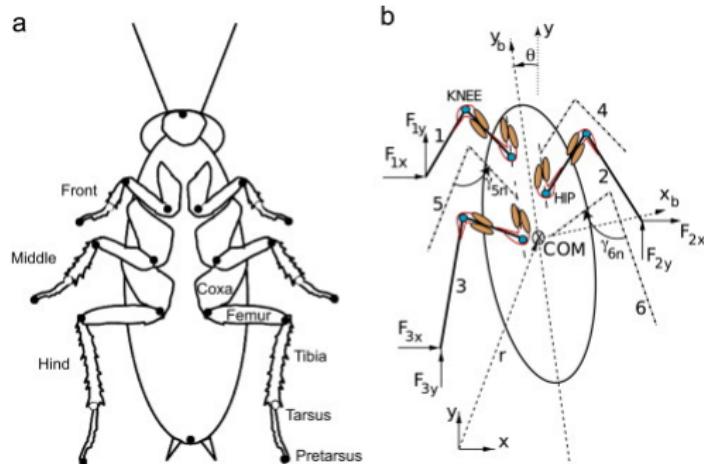
- Got up extra early. Looked through a big book. Picked the coolest one.
- **I had work study. UROP paid as well as waiting tables.**
- Got to hang out in a lab.
- *By blind luck it was a robotics lab with a few women in it.*

DARPA Rules!



- Lab was sponsored by the Defense Advanced Research Projects Agency (DARPA)
- Looking at how cockroaches moved. Can we replicate it?
- Instead of making robots that moved like roaches can we control roaches like robots?

Turns out there are no unsolved problems in robotics.

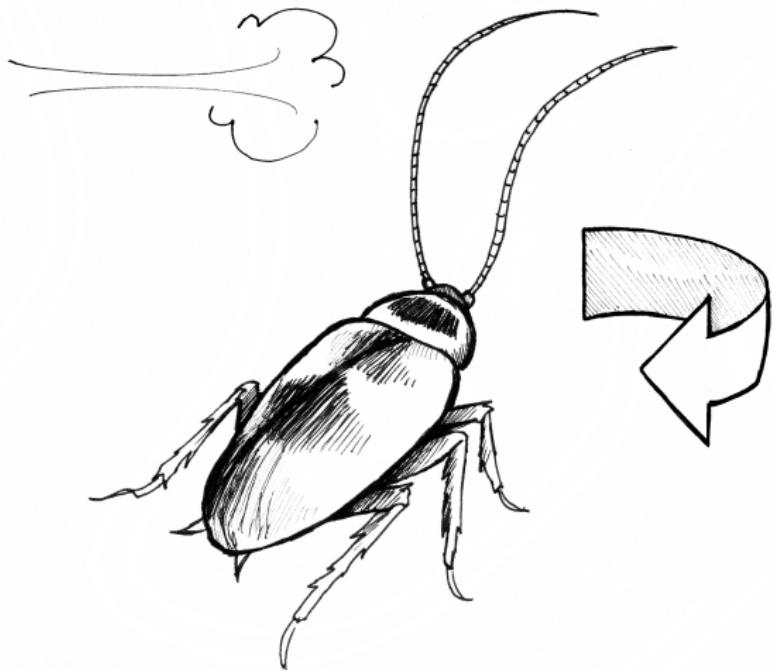


- Mother nature has got this stuff solved.
- The sensors, actuators, and controllers on this bug are perfect.
- We just need to take it apart and figure out how it works.

BACKYARD BRAINS

Some of my old lab mates wanted to educate students on neuroscience. They commercialized some of the technology so students could learn from it. They kindly donated materials for today!

What about the inverse problem? Can we make roaches robots?

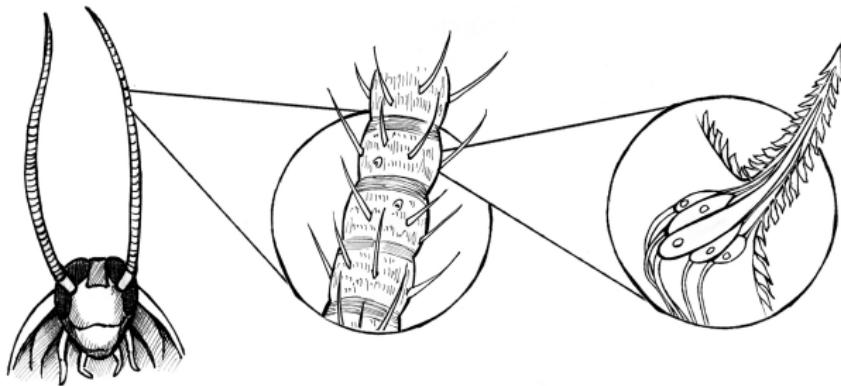


Remember your sensors...



Limit switch....

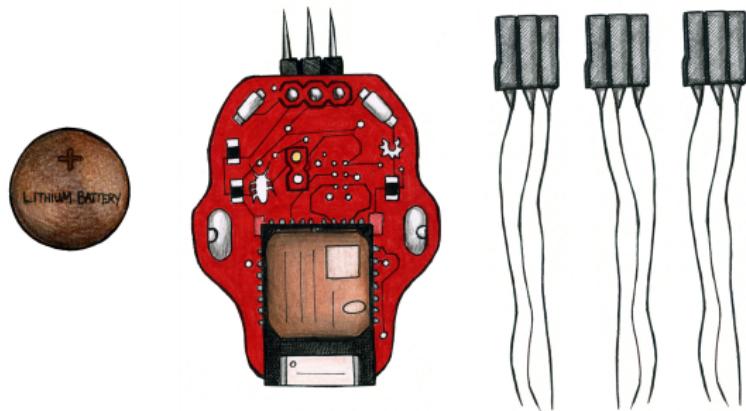
Can we hack into the roaches' sensors?



How does a roach work?

- +/-3V Signal
- Biphasic Square Wave
- Roughly 10-100Hz
- Emulates the signal the neurons would generate.
- Don't worry, the roach will be just fine, we'll leave him a lot of sensor.

So what is going on here?



- Control signals sent from phone via bluetooth.
- On the board bluetooth cpu gets the message, and generates a waveform.
- We then amplify it a bit and send it to the roach via leads.
- Roach says, gee, feels like something is there.

So should we give it a try?

Could we take this to the next level?



What are the parts to getting this done?

DO NOT PANIC. *Break the problem down to little chunks and solve each chunk.*

- Find a bluetooth library to “talk” to the roach backpack.
- Find a library that can get images from the kinect.
- Write some code to get the roach position / orientation.
- Write some code to find the line.
- Write some code that figures out the difference between the roach and the line.
- Figure out a way to relate that difference to stimulation.

Roaches are just the tip of the iceberg...



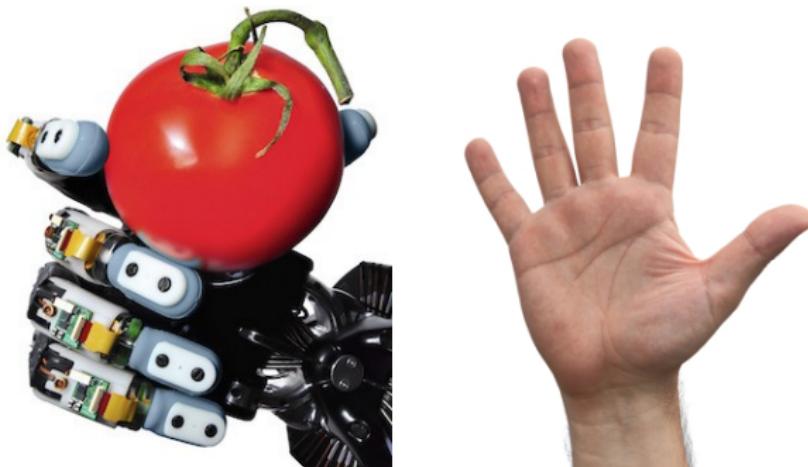
Stereo vision is something we use everyday, why not robots?

Roaches are just the tip of the iceberg...



Bats get around with sonar, why not robots?

Roaches are just the tip of the iceberg...



We can figure out stuff with our hands? Why not robots?

The best part about robotics.



You'll never be chained to a desk. You'll be working with every engineering discipline, biologists, psychologists, and designers. It really is a true interdisciplinary field.

GO BUILD ROBOTS!

Here are a few resources to get you started!

- Back Yard Brains
- I Heart Robotics
- FIRST Robotics Competition
- Robot Operating System (ROS)
- Nodebots!
- Build a Tapsterbot
- GO VISIT A HACKER SPACE.