

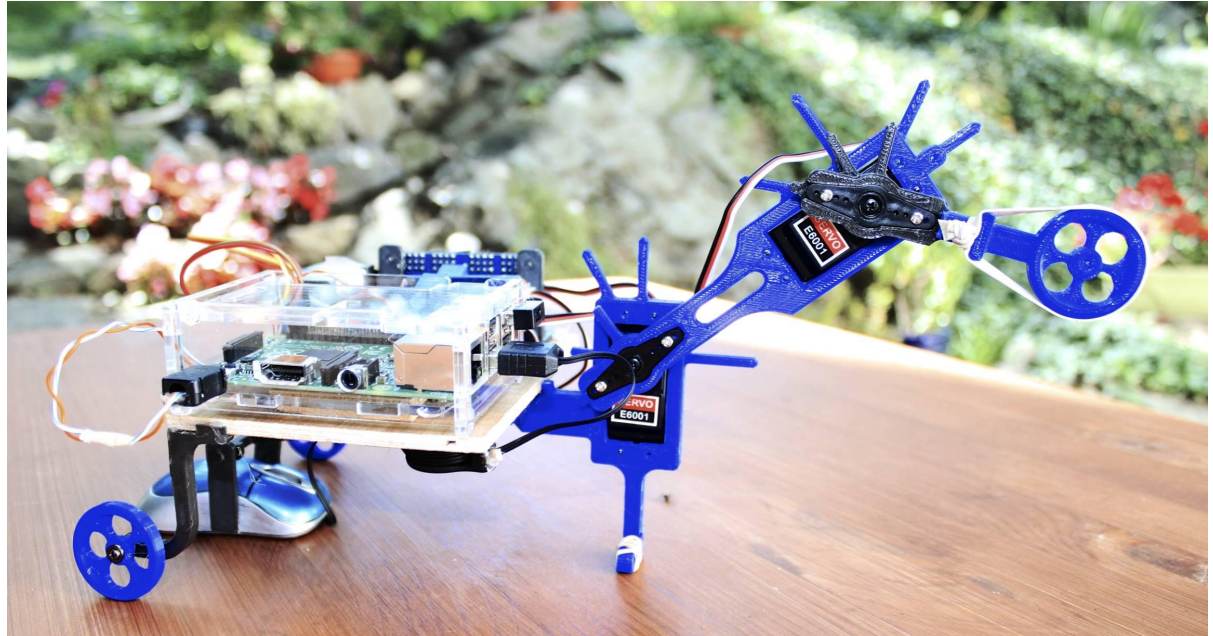
Markov Crawler

Machine learning platform aiding CS188

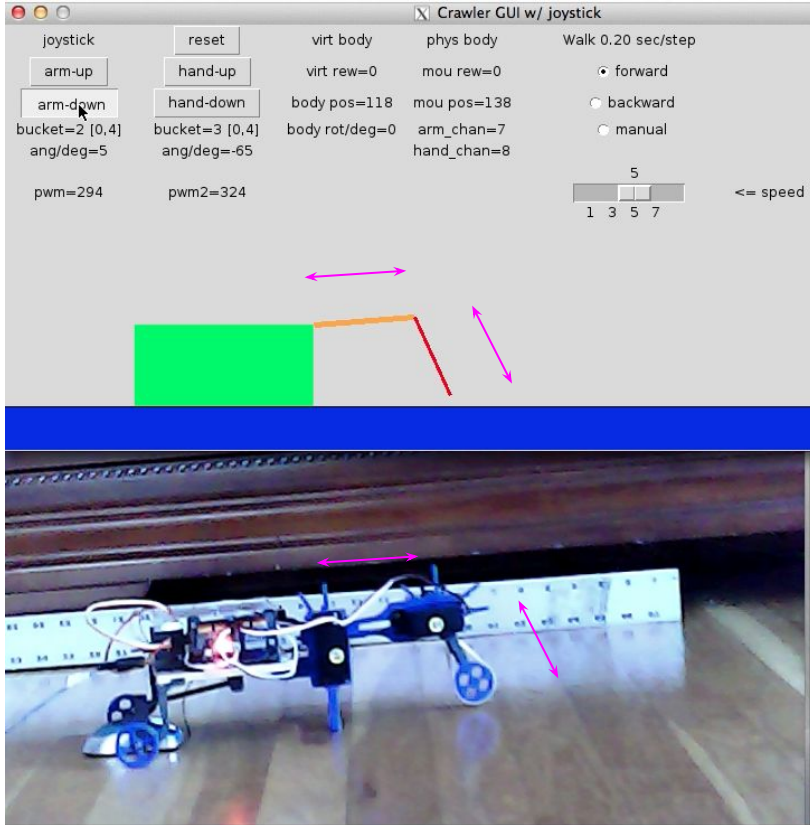
Crawler can execute a reflex agent or Q-learn optimal policy using Markov decision process.

Raspberry Pi runs CS188 AI Python software controlling crawler 2 servo motors for arm and hand, acquiring crawler position from optical mouse.

All parts from eBay or 3D printed, assembly in few hours.

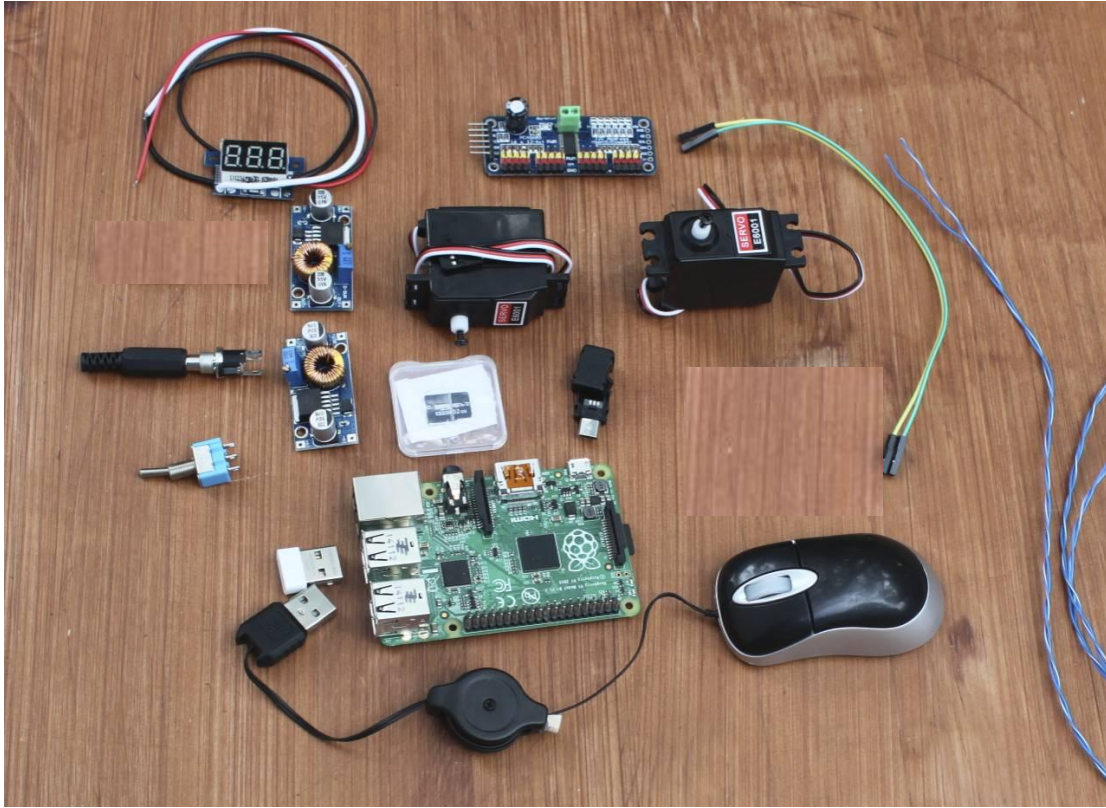


Markov Crawler features



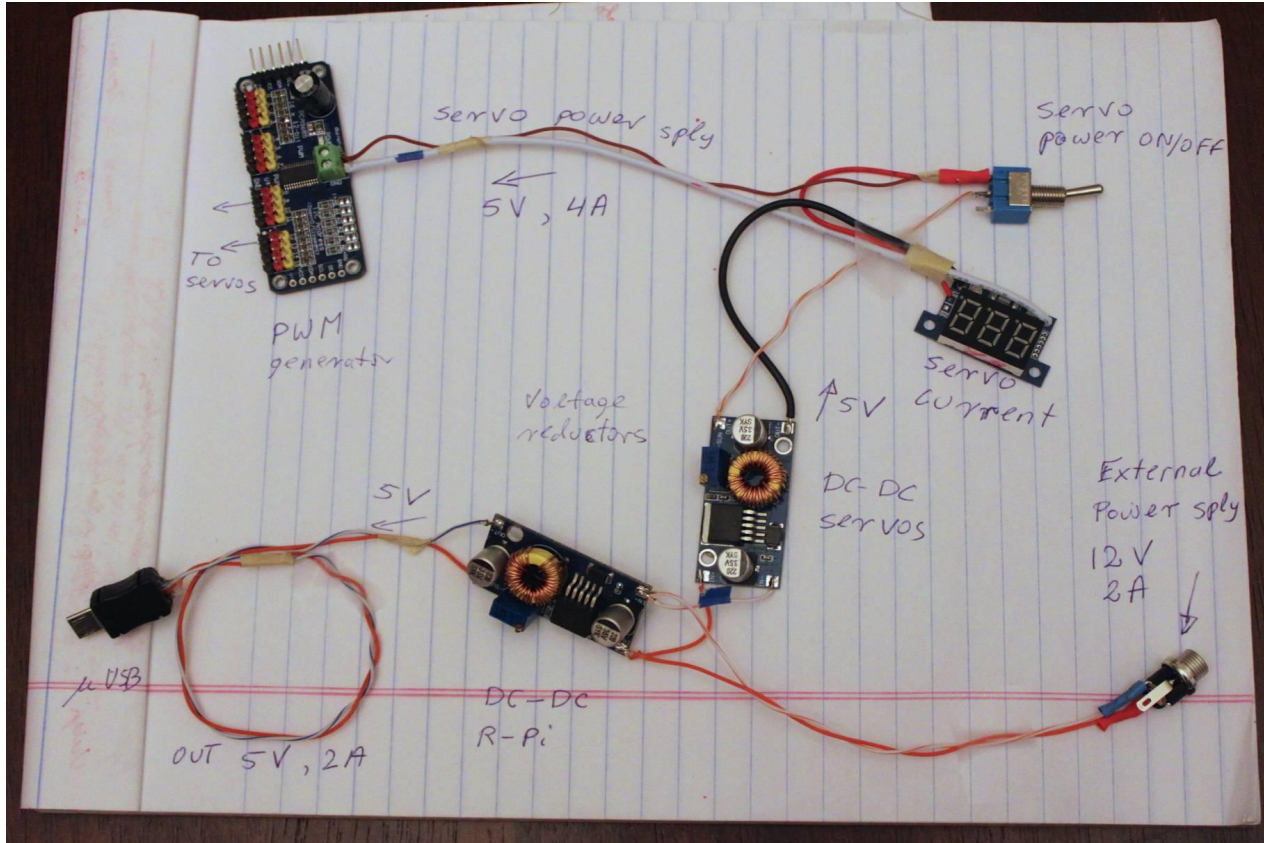
1. Crawler is controlled by an on-board Raspberry Pi running Rasbian, remote ssh is available via WiFi dongle,
2. It is integrated with Python code used in CS188 class,
3. The dimensions of the virtual model (top fig.) are adjusted to physical crawler (bot fig.), computed position matches to the actual one,
4. Crawler can execute reflex-type policy defined by the operator,
5. Crawler can Q-learn policy rewarded by movement of the body measured by the optical mouse
6. Crawler can follows Q-policy inferred from the real body position or from the virtual model

List of key prefabricated parts



- Raspberry Pi SoC
- muSD memory card
- WiFi dongle
- mini optical mouse
- PWM generator
- standard 5V servo motor x2
- DC-DC 5V/4A step-down voltage converter x2
- usb plug to power R-Pi
- servos On/Off switch
- Ampere meter (optional)
- 120V AC-12V/4A DC power supply (not shown)
- flexible 3m long 12V power supply cable

Electrical harness to be assembled



Electrical assembly takes 2 hours for a person with moderate soldering experience.

A single 12V/4A power supply is connected via flexible 2-wire conductor (not shown).

Average power consumption

$$0.5A * 12V = 6W$$

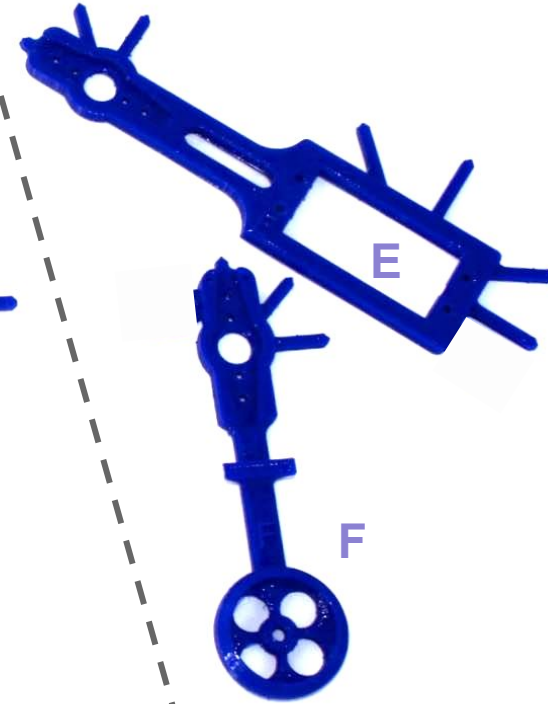
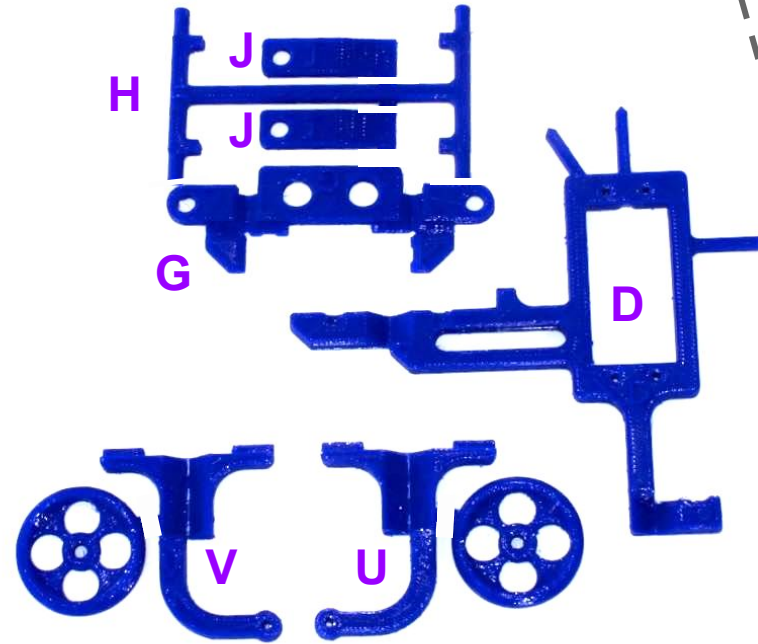
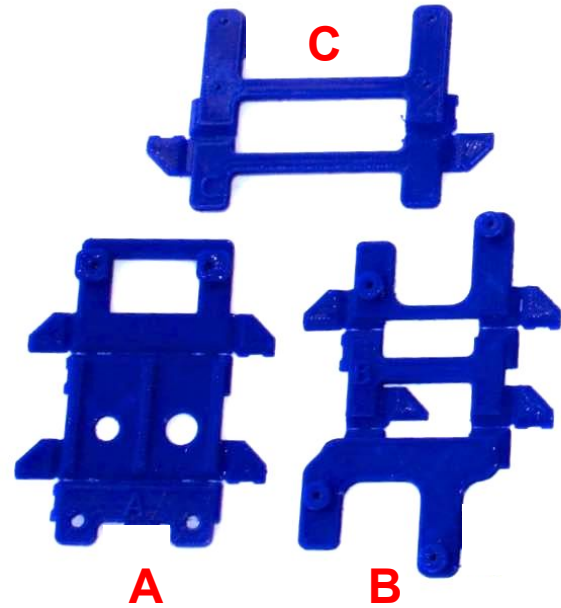
- R-Pi w/ WiFi & opt-mouse
 $0.7A * 5V = 3.5W$
- 2 servos peak total power
 $2A * 5V = 10W$

List of 3D printed parts

Upper Body Parts

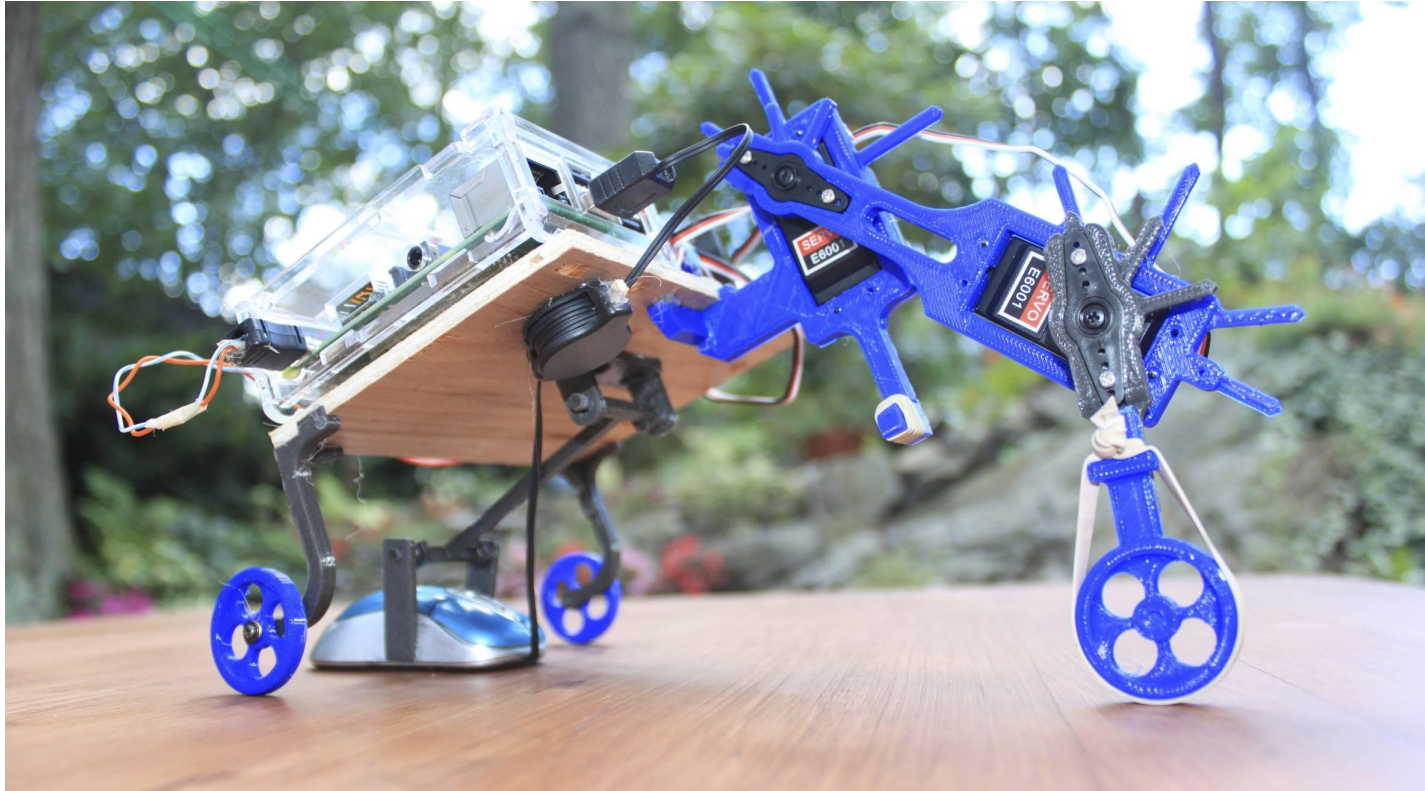
Undercarriage Parts

Arm and Hand

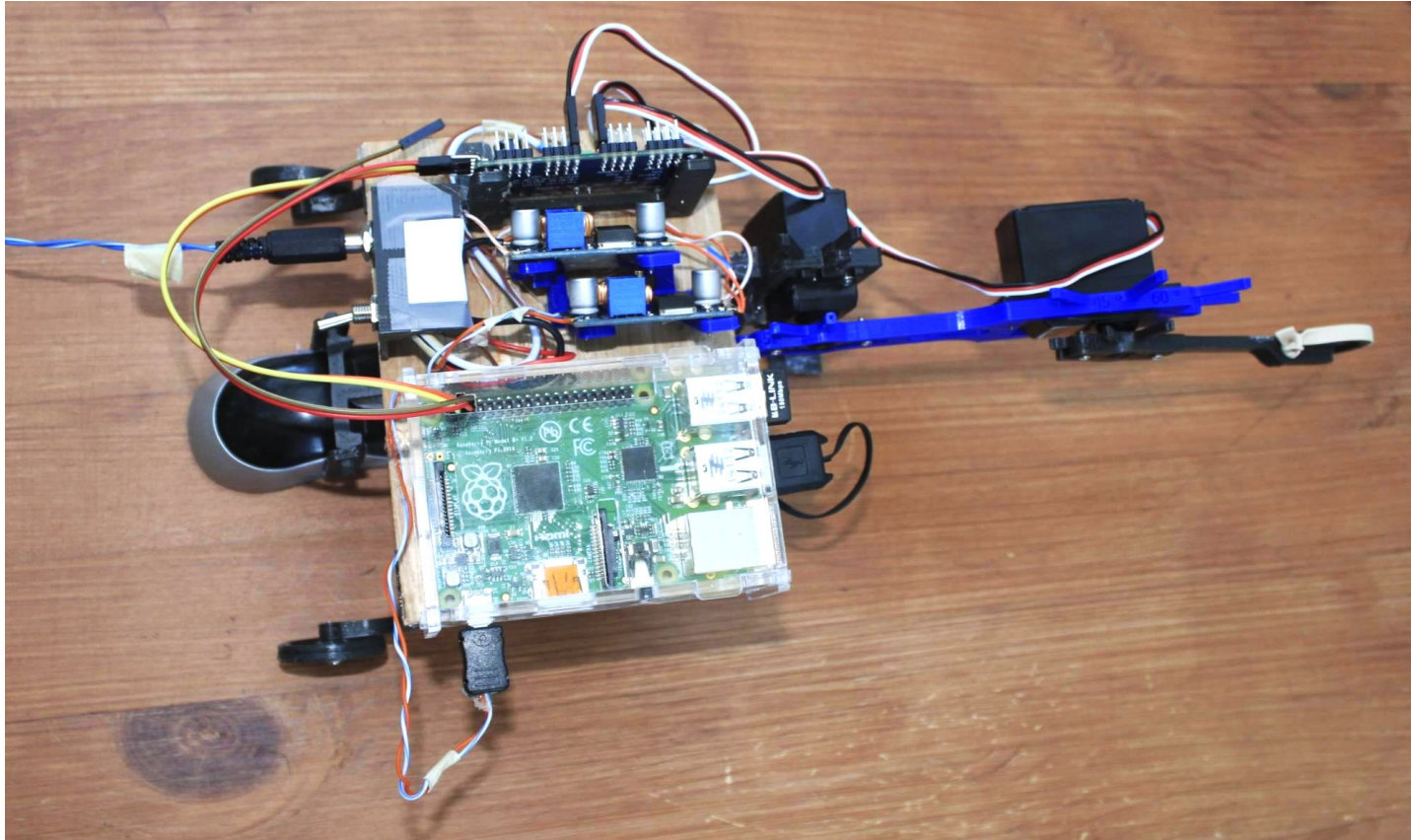


Mechanical assembly

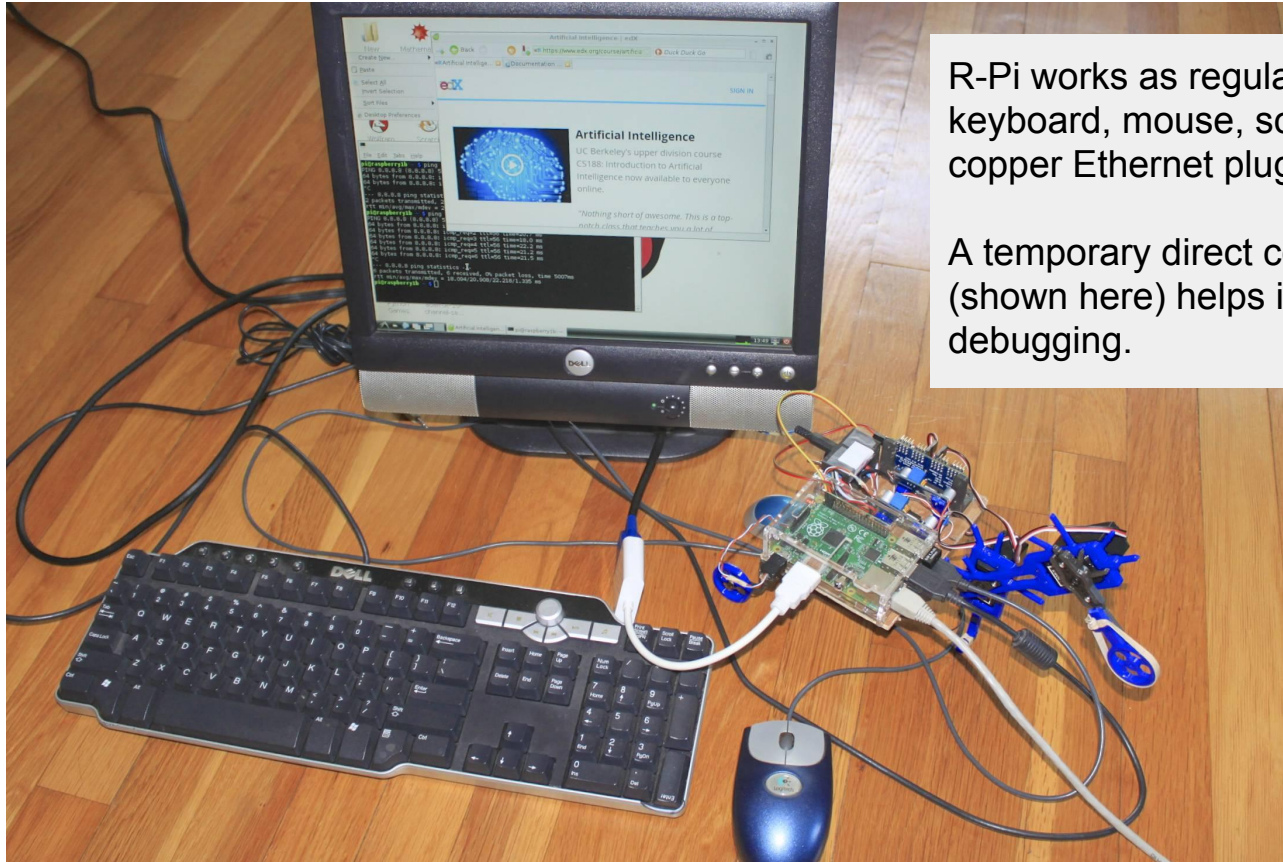
Mechanical assembly takes 2 hours, requires glue-gun, screwdriver, utility knife.



Markov Crawler top view



Connection to R-Pi via WiFi or directly



R-Pi works as regular a PC with keyboard, mouse, screen, and copper Ethernet plugged in.

A temporary direct connection to R-Pi (shown here) helps in the low-level debugging.

Markov Crawler Parameterization

