DropBot: an open-source platform for lab automation

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I: How did I end up here???
II: DMF and the DropBot
III: General insights
MASc in Imaging physics

- got to play with super cool million dollar gadgets
- take pictures of my friends’ brains
- chance to positively impact health care
Reality is frustrating

- incremental advances
- no culture of sharing (few exceptions)
- reinventing the wheel
- trying to reverse engineer a black box
- boss is not happy if you want to take apart magnet
Science needs open technology platforms, not appliances.

- Jordan Miller, OHS 2012
My introduction to hardware
I: How did I end up here???
II: DMF and the DropBot
III: General insights
Hello Microfluidics

Kenis et al.,
*Science*, 1999
285 83-85
Digital Microfluidics (DMF)

Prof. Aaron Wheeler
University of Toronto
Sample applications

Cell culture and biological assays

Chemical synthesis

Diagnostics

Proteomics

http://microfluidics.utoronto.ca
DropBot

Fobel et al., *Appl. Phys. Lett.*. 2013, 102, 193513

Christian Fobel
Maximum flexibility, easy to extend

• modular/decoupled hardware (40 to >1000 channels)

• and software plugin architecture

• I²C/power (+/-12V, +5V, +3.3V) breakouts (i.e., to add sensors/actuators)
Example plugin: magnetic separations

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Open hardware risks/rewards are different for scientists vs entrepreneurs

Advantages (relative to entrepreneurs):

– don’t need to be profitable (increased visibility/citations/opportunities for collaboration)
– get paid (research grants) even though you’re giving it away
– get help improving the tools you need for your experiments

Disadvantages:

– not always possible (university may own your IP)
– hard to develop in the open (want to keep things secret until paper is published)
– stigma against application-based vs hypothesis-driven research
Consumers want appliances:
just work and easy to use

Scientists want open platforms
Consumers want appliances: just work and easy to use

Scientists want open platforms (that feel like appliances)
Generalized liquid-handling platform on every bench?

Throughput vs. Cost

- Manual
- DropBot
- Liquid handling robots

?
Thank you!

- Aaron Wheeler
- Christian Fobel
- Wheeler Lab