Prototyping Pervasive Systems

COMP5047 – Lecture 09 - 2

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What is a prototype?

- One manifestation of a design that allows stakeholders to interact with it

Source: PalmPilot wooden model © Mark Richards

- In other design fields, a prototype is a small-scale model:
  - A miniature car
  - A miniature building or town

howtospendit.ft.com

Why Prototype?

- Get very early evaluation and feedback (hands-on)
  - Stakeholders can see, hold, and interact with a prototype more easily than a document or a drawing
- Team members can communicate effectively
- Ideas can be tested out
  - E.g. technical feasibility
- Easy and quick to make changes

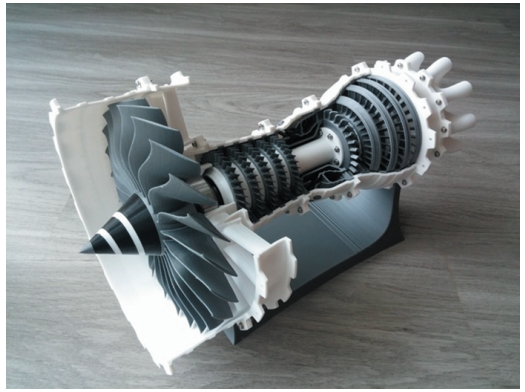
Why Prototype?

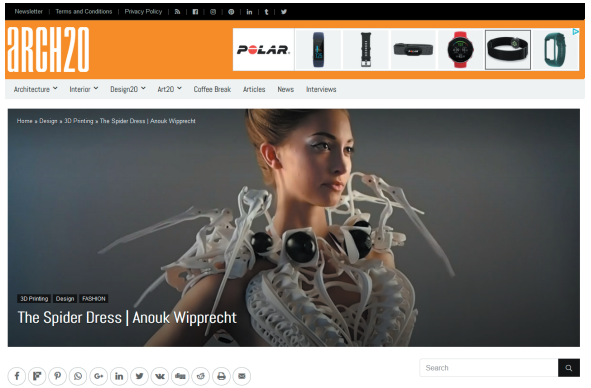
- Prototyping encourages reflection
  - Understand better by building
  - Clarify vague requirements

- Prototypes answer questions and support designers in choosing between alternatives

Prototypes

- Can range from
  - Sketched interface
  - A slide show
  - A simulation
    - e.g. video
  - Physical model
    - e.g. clay model, 3D print, cardboard mock-up
  - Software program with limited functionality
  - Hardware with limited functionality
- Not limited to these

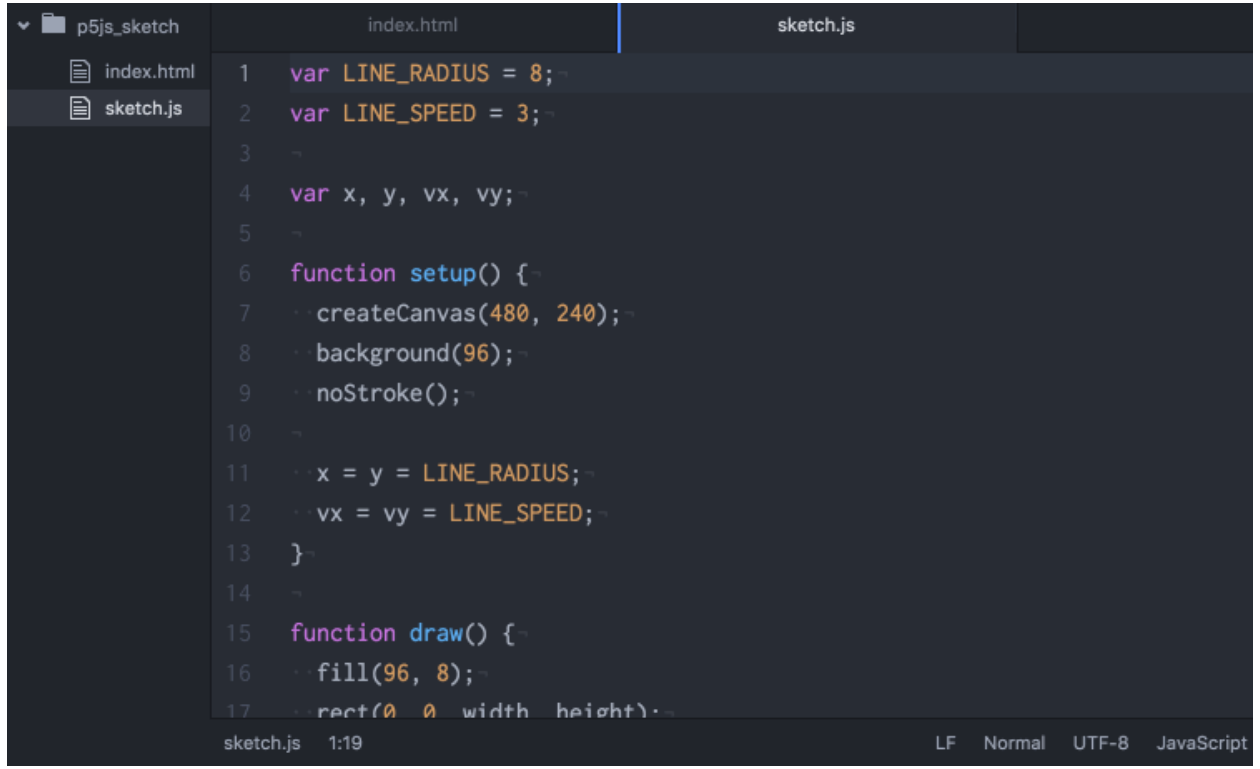




www.id-book.com

Software Prototyping Tools

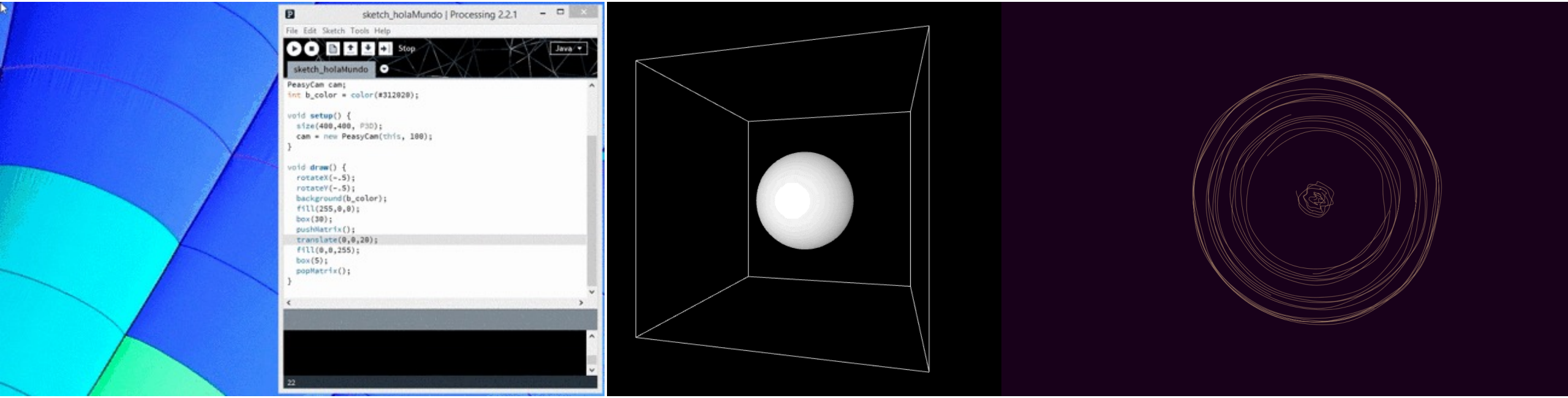
- **Processing.org**
  - A programming IDE for prototyping
- Supports many libraries
  - Video, Audio, Network, Animation, Vision, ML
- Based on Java



processing.org

Software Prototyping Tools

- **Processing**



processing.org

Physical Prototypes

- Ranges from low to high fidelity
  - From wood, clay; to, laser cutting, 3D printing
- Experience the physical aspect
  - Size, how it fits in the hand, weight
  - How easy to manipulate
  - Haptic feedback
- However, physical functionality is limited

Source: PalmPilot wooden model © Mark Richards

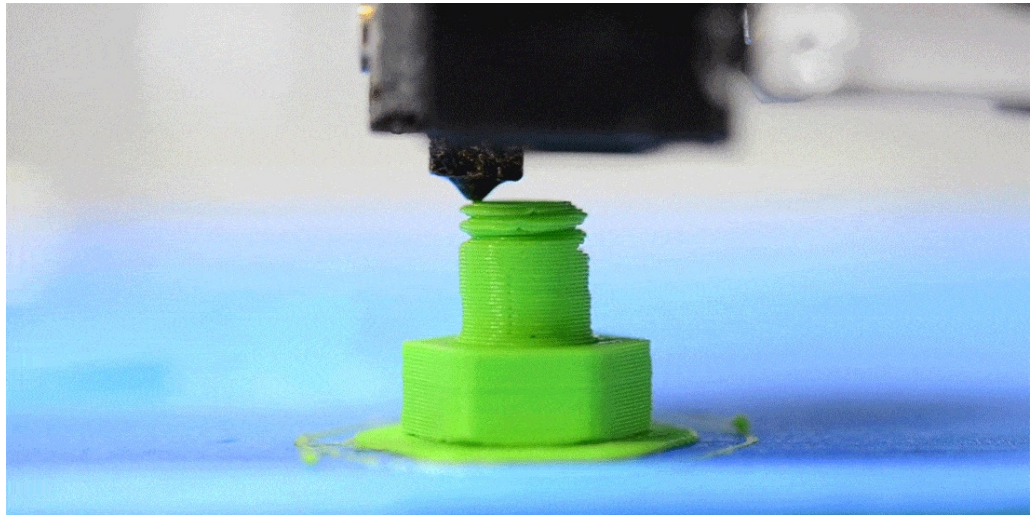
Rapid Fabrication

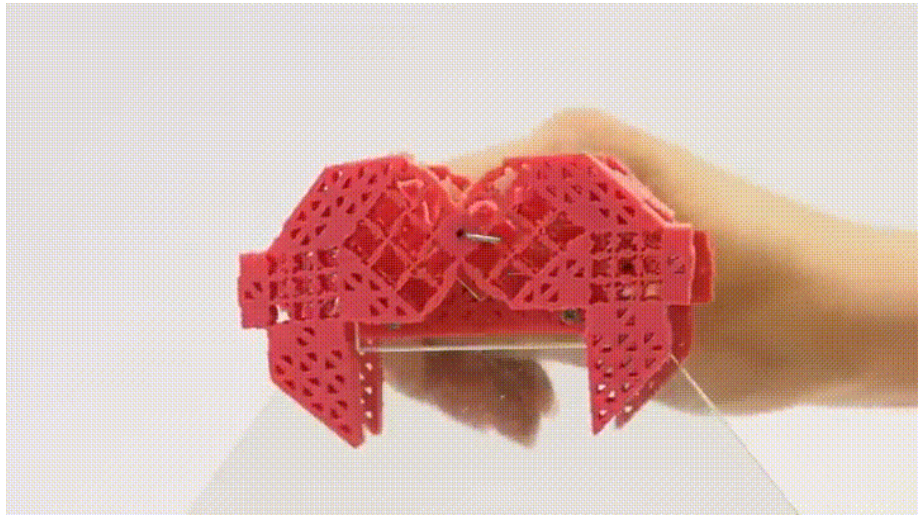
- Computer aided production tools
  - E.g. 3D printers (additive manufacturing), laser cutters (subtractive)

- Helps to quickly fabricate high quality physical prototypes
  - Easy to modify and change

3D printing

- Additive manufacturing

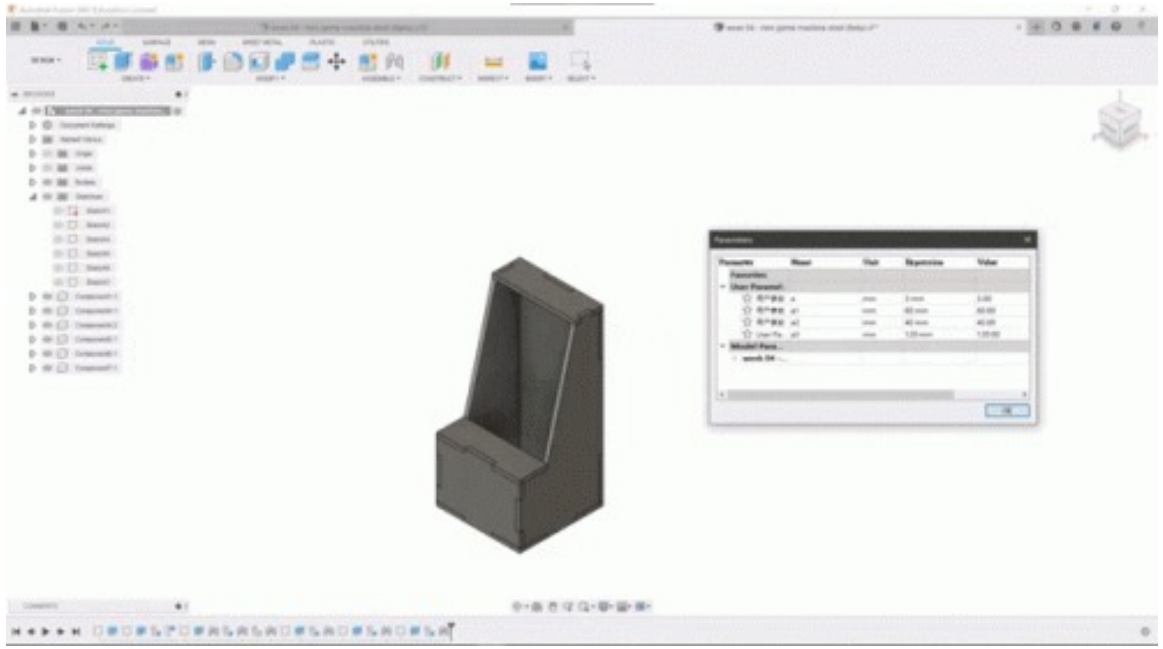




academy.autodesk.com
https://hpi.de/baudisch/projects/metamaterial-mechanisms.html

3D printing

- Can be slow and expensive
- Need a good 3D design

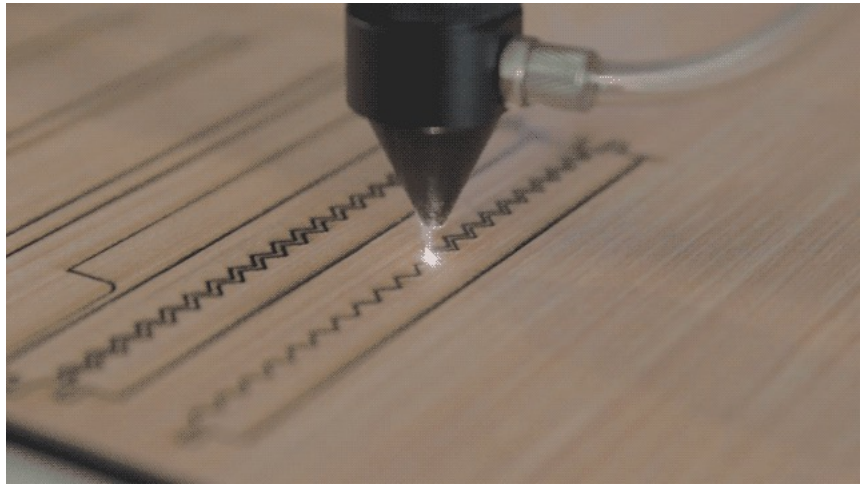


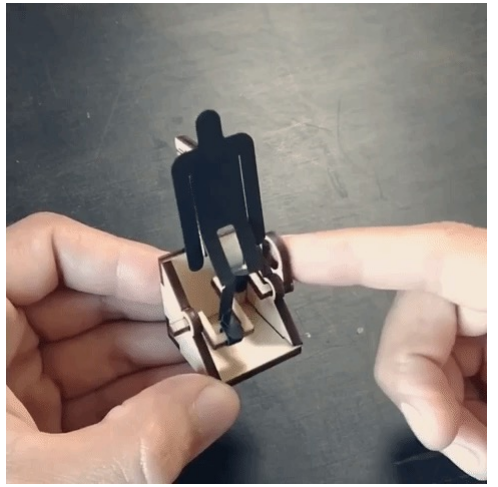
Fusion360

https://tenor.com/view/fusion360-gif-25018714

Laser Cutting

- Subtractive manufacturing

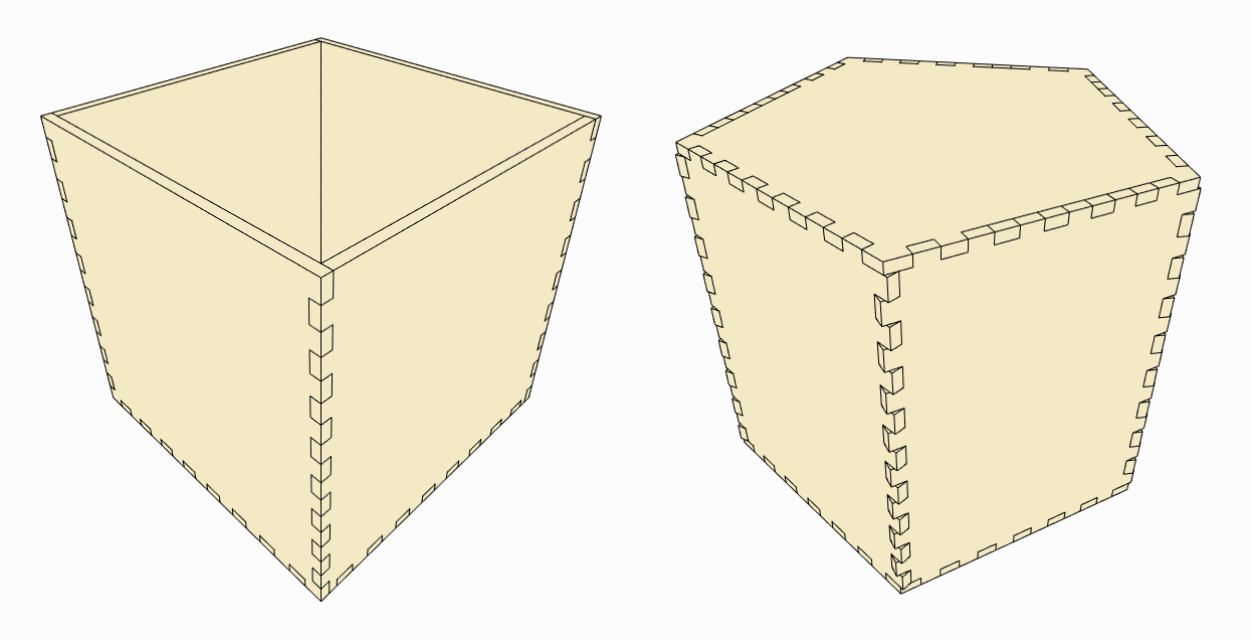




community.glowforge.com
www.pinterest.com.au/pin/30891947431571976/

Laser Cutting

- Fast and inexpensive
- Limited in the kind of designs
- Designing can be complicated
- Check
  - https://en.makercase.com/



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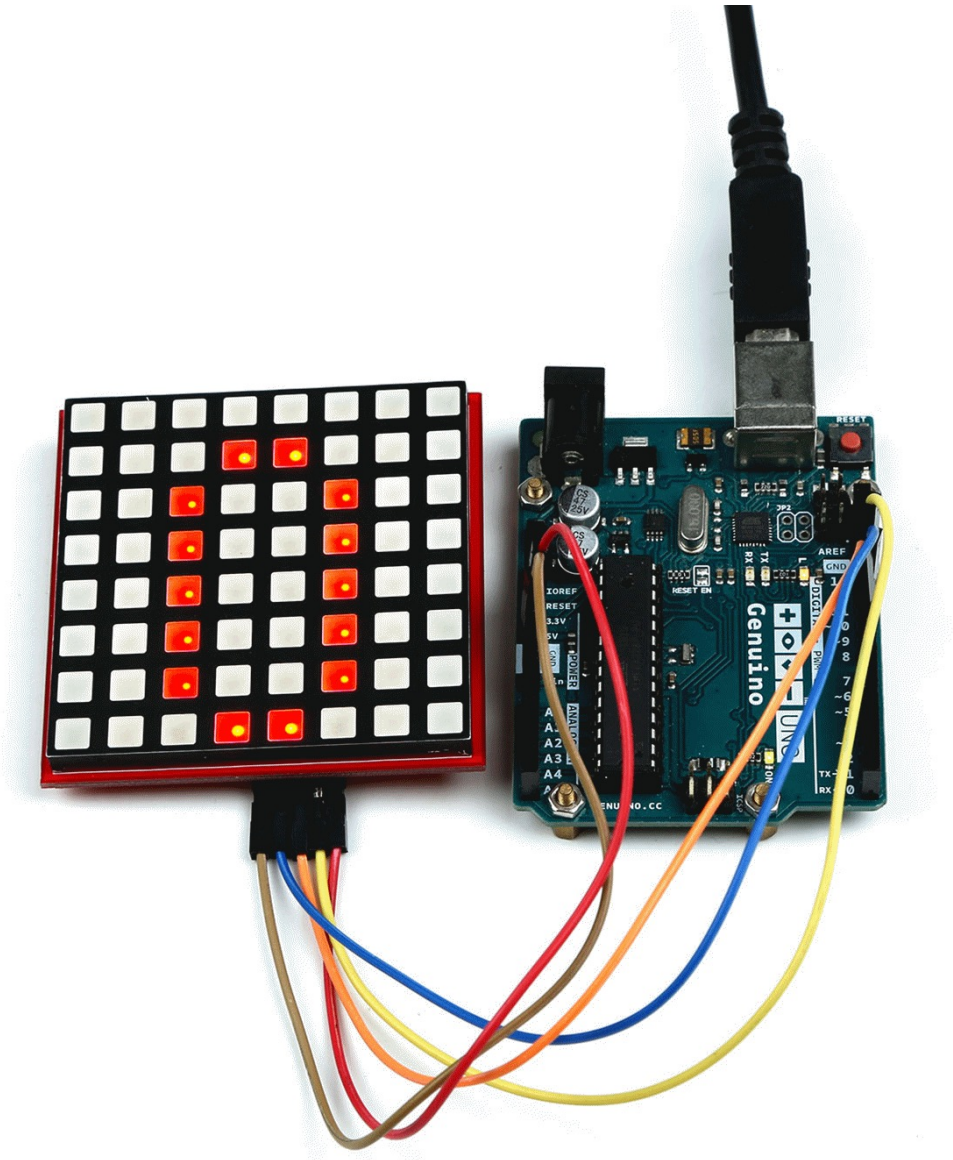
Arduino

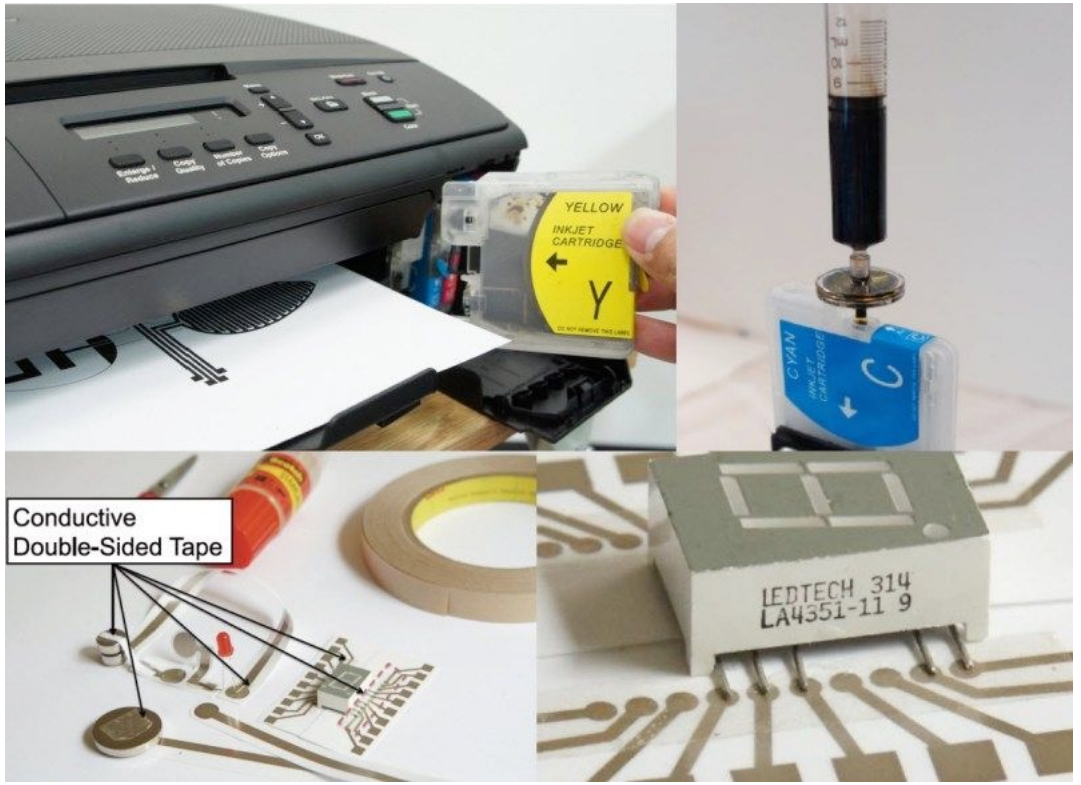
Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects.



https://www.arduino.cc/

Printed Electronics

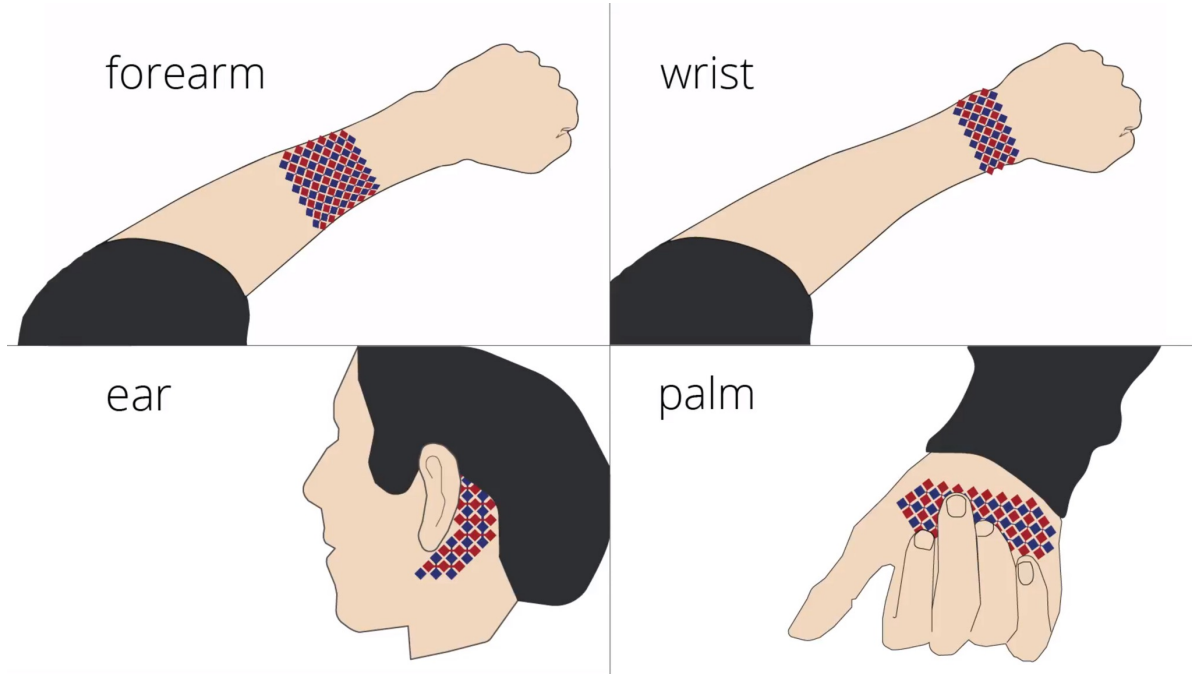
- Print electronics with inkjet printers
  - Use silver Nano-particles
- Commercial ink-jet printers
  - ~100 AUD
- Paper or PET substrates



Y. Kawahara, S. Hodges, B. Cook, C. Zhang, G. Abowd: Instant Inkjet Circuits: Lab-based Inkjet Printing to Support Rapid Prototyping of UbiComp Devices, Proc. UbiComp, 2013

Personalized Wearable Multi-Touch Sensor

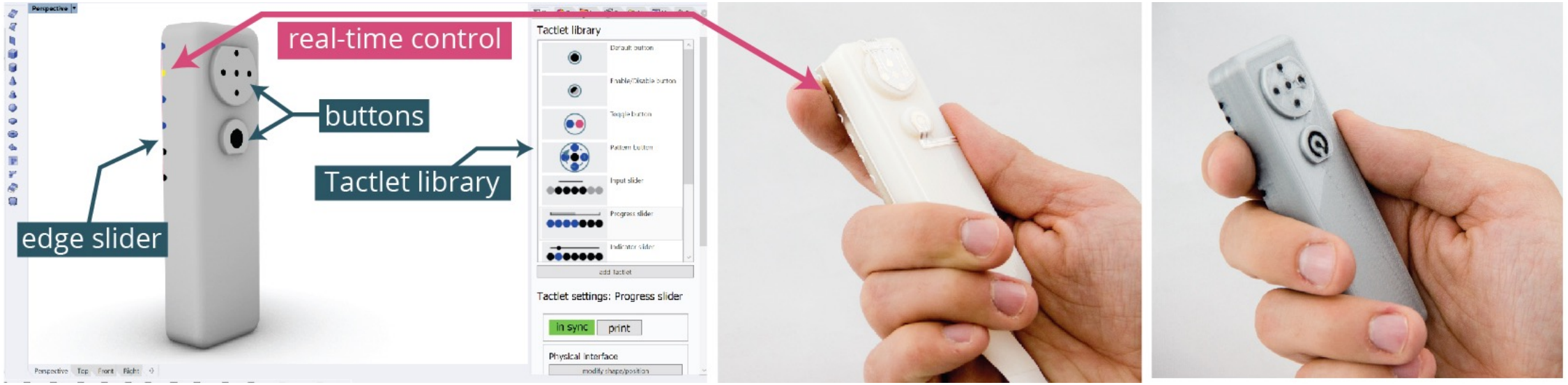
Design Tool for Custom Form-Factors



A. S. Nittala, A. Withana, N. Pourjafarian, and J. Steimle, "Multi-Touch Skin: A Thin and Flexible Multi-Touch Sensor for On-Skin Input," in Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18, 2018, pp. 1–12.

The designs can be easily fabricated and tested with a ink-jet printer

Now You Can 3D Print Electronics Too



D. Groeger, M. Feick, A. Withana, and J. Steimle, “Tactlets: Adding Tactile Feedback to 3D Objects Using Custom Printed Controls,” in The 32nd Annual ACM Symposium on User Interface Software and Technology - UIST ’19 (to appear), 2019.

Summary

- What is a prototype?
- Why prototype?
- Some prototyping approaches
- Resources for prototyping

Image https://www.dnsstuff.com/

Practical Work

- Try designing boxes for the devices you make in the project