Digitálne výrobné technológie

- **Prednášky**
  - FEI, D-208, streda 9:00, **notebooky**
- **Cvičenia**
  - FabLab, streda 11:00, **podklady**
- **Exkurzia**
  - MicroStep Bratislava
  - **MakerFaire Vienna**

3. - 4. 6. 2023

Maker Faire Vienna

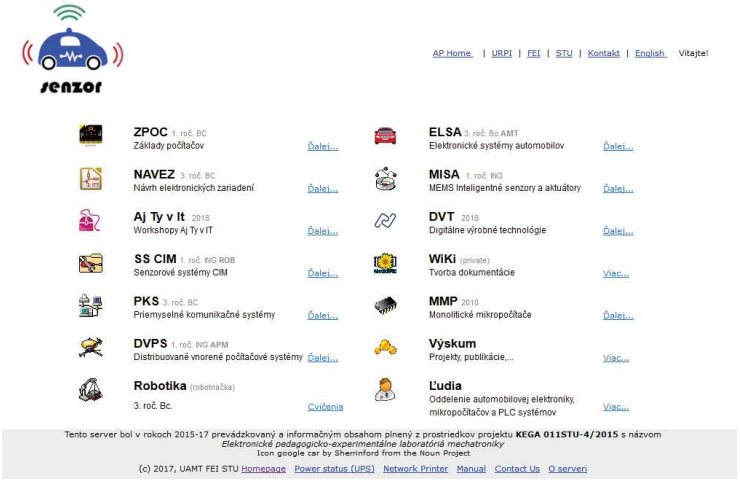
- **Projekt**
  - prezentácia, dokumentácia (wiki), **výrobok**

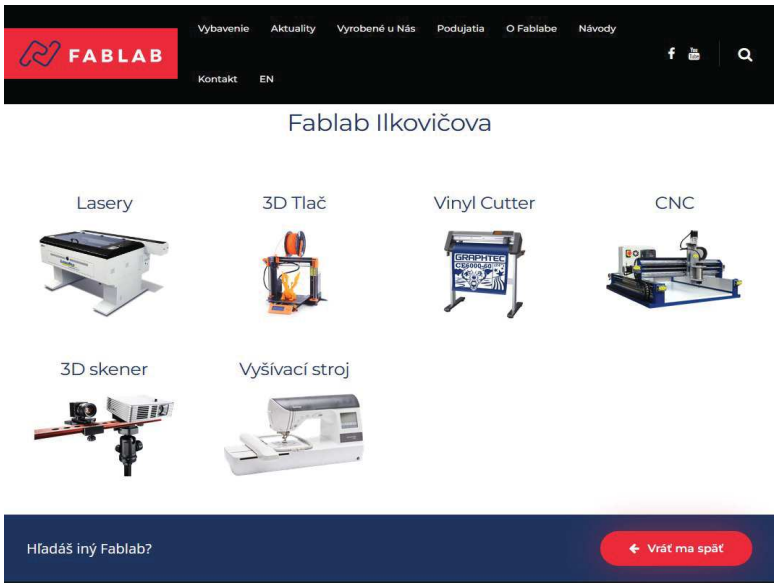
https://classroom.google.com

Google Classroom

vbk7w35

http://senzor.robotika.sk/





Harmonogram

- **P1: úvod**
  - C1: FabLab: prehliadka a zoznámenie s priestormi
- **P2: elektronika (notebook)**
  - C2: FEI: schéma a plošný spoj
- **P3: bitmapy/vektory, rezanie (notebook)**
  - C3: FabLab: nálepka / tričko (10x10 cm)
- **P4: laser, materiály (notebook)**
  - C4: FabLab: prívesok (5x5 cm)

10,- € príspevok na materiál

Zoznam úloh (hodnotenie)

3T: nálepka alebo tričko – vinyl cutter

5T: prívesok – laser cutter

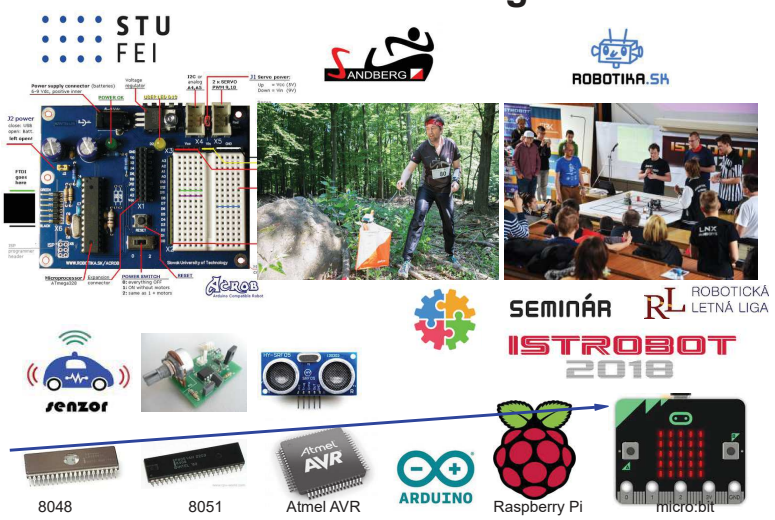
7T: minca, figúrka – 3D tlačiareň

9T: elektronický projekt

12T: Záverečná prezentácia projektu
(prezentácia, dokumentácia a hotový výrobok)

\+ Priebežné tvorivé úlohy

Richard Balogh



Jozef Vaško

TECHNICKÁ UNIVERZITA V KOŠICIACH

CENTRUM VEDECKO-TECHNICKÝCH INFORMÁCIÍ SR

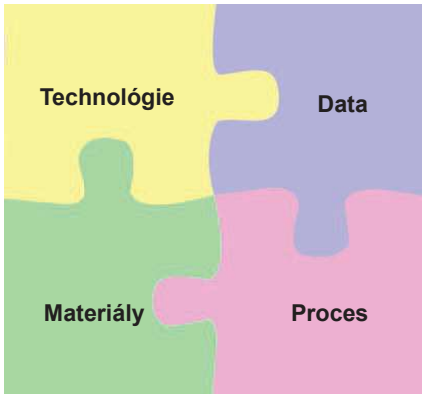
FABLAB

Študoval rádioelektroniku na Technickej univerzite v Košiciach. Pracoval v Ústave merania a meracej techniky SAV. Bol odborný zamestnanec novovzniknutého Ústavu pre výskum a vývoj zdravotných systémov Chirany v Bratislave. Od roku 1990 zmenil pracovisko a venoval sa projektovaniu a realizácii počítačových sietí a informačných systémov. O rok neskôr založili s kolegami akciovú spoločnosť, ktorej bol súčasne akcionár aj zamestnanec. Od roku 2013 je v Centre vedeckotechnických informácií (CVTI) v Bratislave. Od novembra 2014 má na starosti prevádzku dielne Fablab.

Kto?

Prednášateľ: **Ing. Richard Balogh, PhD.**
miestnosť: D-110
mail: balogh@elf.stuba.sk
nepoužívajte ais na mail

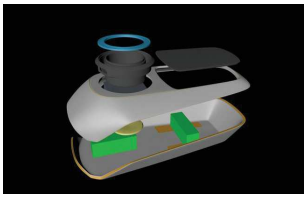
- Jozef Vaško
  Pavol Krajčík, Terka Kaliňáková,... = FabLab
- A kto ste vy? Čo tu chcete?



Continental
The Future in Motion

https://techbox.dennikn.sk/ploche-obrazovky-v-autach-coskoro-nahradia-tvarovane-displeje/

STU FA



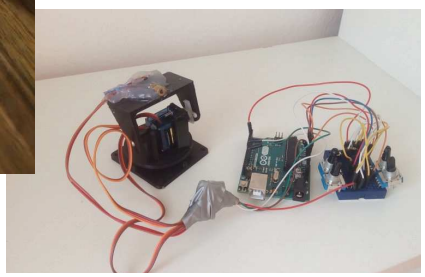
STU FA

ST FA

RANÁ STAROSTLIVOSŤ

STU FA

RANÁ STAROSTLIVOSŤ

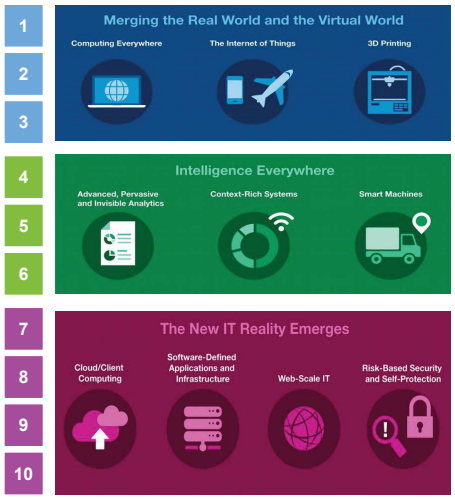


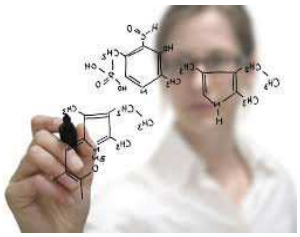
Fit2Digital

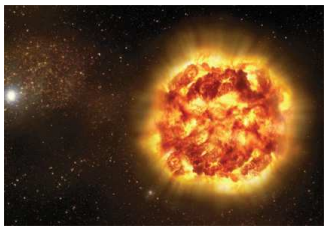
TECHNOLOGY trends

Gartner **Top 10 Strategic Technology Trends for 2015**

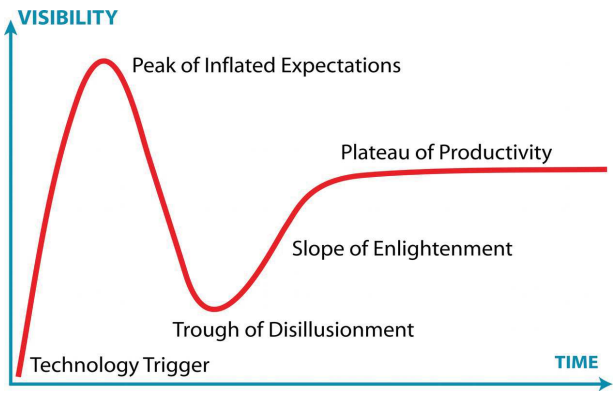
Forbes







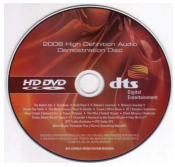
Hype Cycle



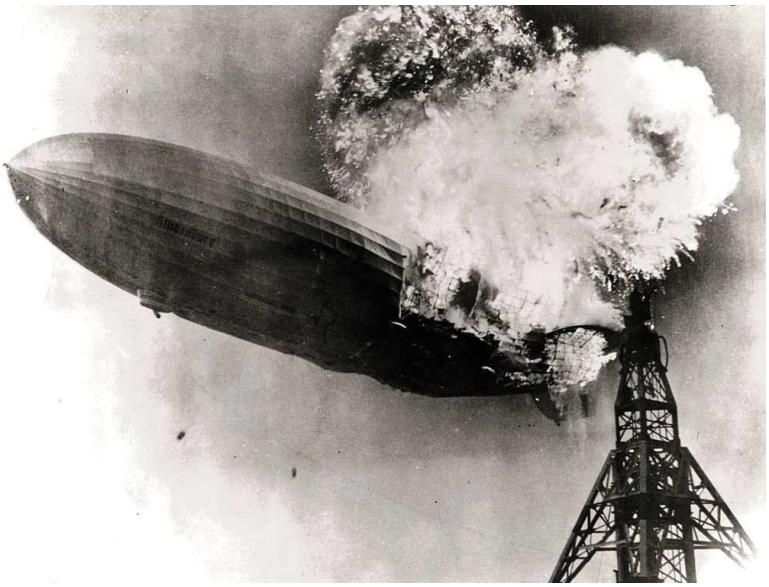
3D TV

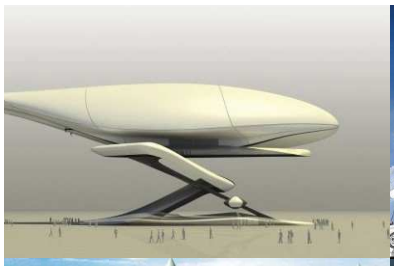
Virtual reality

Iridium



HD DVD





Top 10 Strategic Technology Trends

1	Computing Everywhere
2	The Internet of (any)Things
3	3D Printing
4	Advanced, Pervasive, Invisible Analytics
5	Context-Rich Systems
6	Smart Machines
7	Cloud/Client Architecture
8	Software-Defined Infrastructure and Applications
9	Web-Scale IT
10	Risk-Based Security and Self-Protection

Digitálna výroba

Analógový

Robert Kaliňák, 30. 5. 2016. Zdroj: Dennik N, https://dennikn.sk/473801/kalinak-basternakovi-klame/

CIM = CAD + CAE + CAP + CAM + CAQ

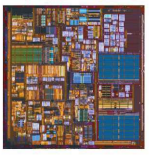
Počítačom podporované...

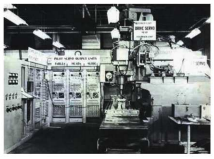
CAD – Computer Aided Design – … návrh, konštrukčná príprava výroby
CAE – Computer Aided Engeneering – … vývoj (výpočty, simulácie)
CAP – Computer Aided Planning – … plánovanie, technologická príprava výroby (technologické postupy, NC programovanie)
CAM – Computer Aided Manufacturing – … výroba (CNC, DNC) podpora riadenia výrobných strojov a robotov
CAQ – Computer Aided Quality - ...riadenia kvality výroby (analýza porúch, systémy kvality)
CAT – Computer Aided Testing – testovanie funkcií výrobkov, kontrolných meraní
CAA – Computer Aided Assembly – uplatnenie pri montáži a expedícii výrobkov
CAST – Computer Aided Stroage and Transport - doprava a skladovanie
CAO – Computer Aided Office – podpora evidencie a obehu elektronických dokladov

Digitálne revolúcie

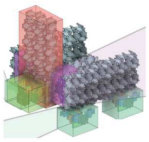
analog → digital communication

analog → digital computation

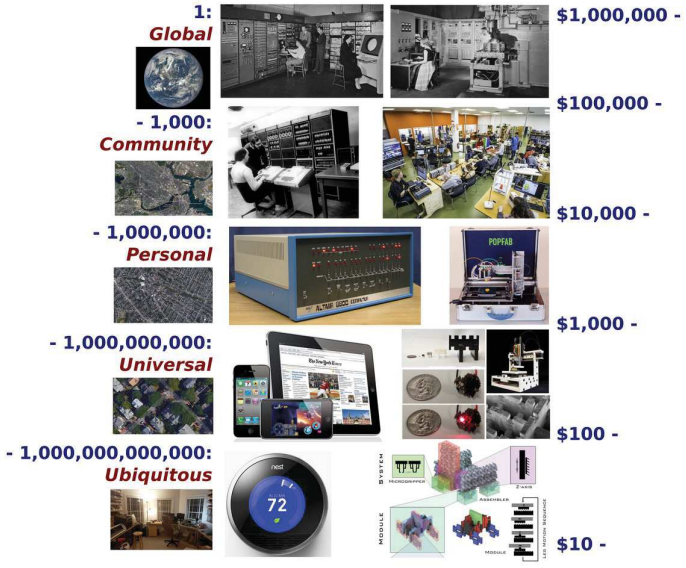




analog → digital fabrication



THE CENTER FOR BITS AND ATOMS
Massachusetts Institute of Technology



Univerzálna skladačka

ako vyrobiť hocičo

LEGO
3D tlač
Integrované obvody / CMOS

Chrám sv. Anny, Vilnius, Litva (r. 1500)

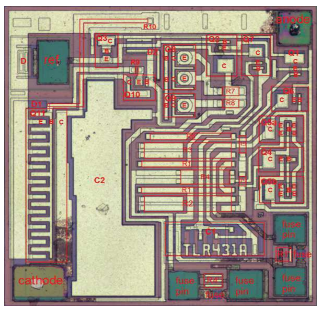
Radnice Prostějov,
T. Lázna, VUT Brno (2022)

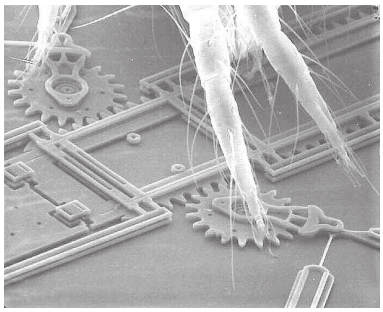
3D tlač

https://www.3dwasp.com/en/3d-printed-house-tecla/

MEMS Micro-electro-mechanical systems

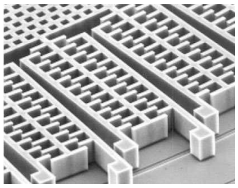
je označenie samotnej technológie ako aj produktov vyrobených technológiou podobnou výrobe integrovaných obvodov

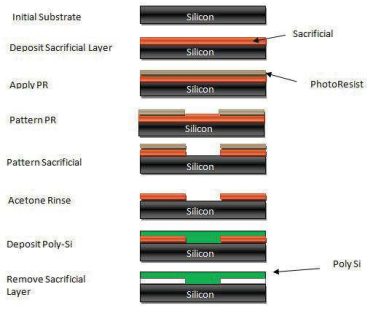




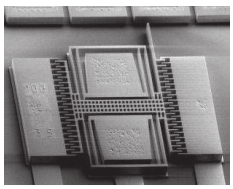
MEMS Micro-electro-mechanical systems

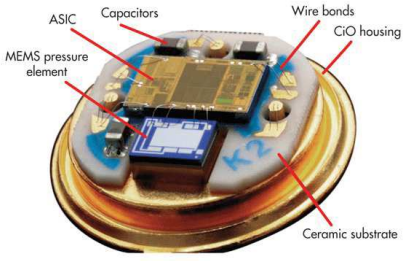
- Nanesenie fotocitlivej krycej vrstvy
- Osvit
- Vyvolanie fotocitlivej vrstvy
- Omývanie
- Leptanie
- Čistenie
- Puzdrenie

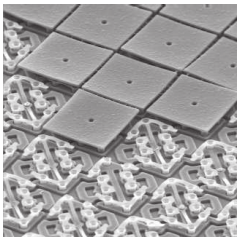




MEMS – inteligentný senzor a aktuátor







Máme problém...

1 meter^3 build volume / 1 mm^3 voxel = 10^9 voxels

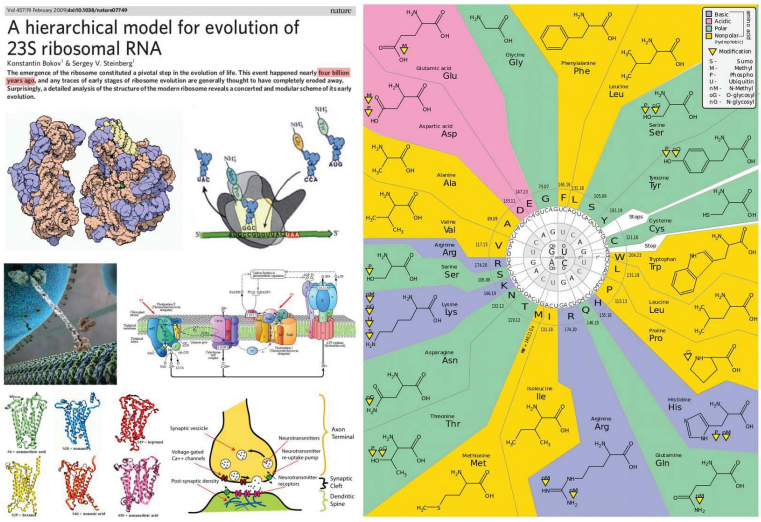
ink-jet printing = 10^4 drops/second

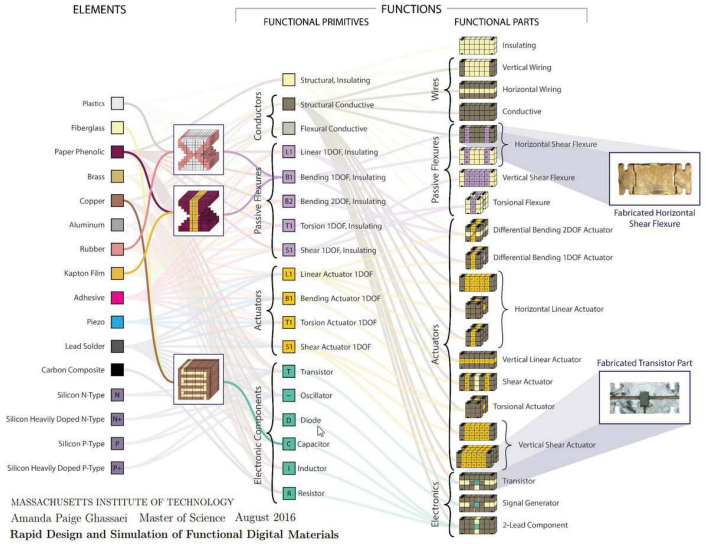
10^9 parts / 10^4 parts/sec = ~day

0.1 mm^3 parts = ~3 years
1 micron^3 parts = ~3 million years

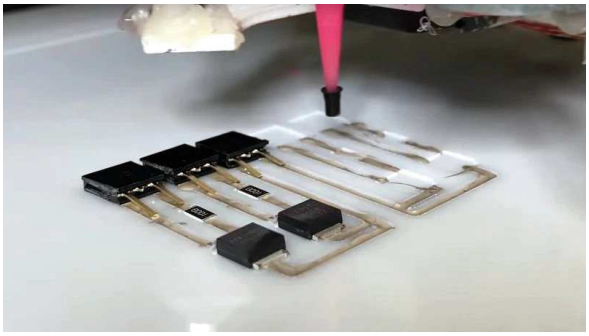
ink-jet head: ~10^3 nozzles
3 million years/1000 = 3000 years

ribosome = ~1 amino acid/second
~10^5 ribosomes/cell
~10^{13} cells/body
10^{18} parts = ~1 second



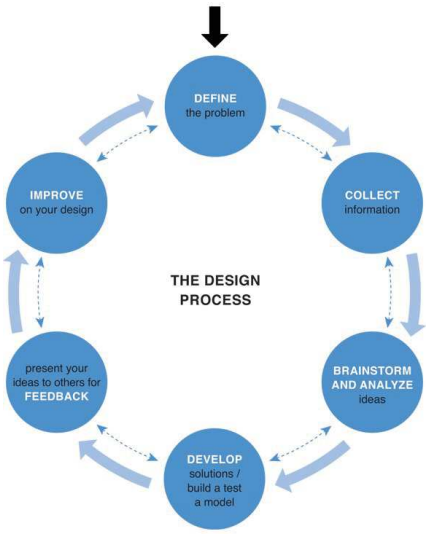


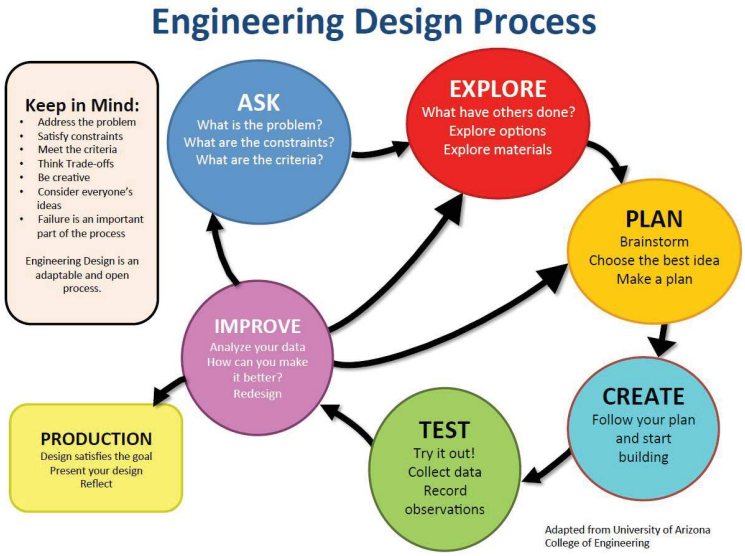
LaserFactory: An Electromechanical Assembly and Fabrication Platform Integrated with a Laser Cutter to make Functional Devices and Robots.

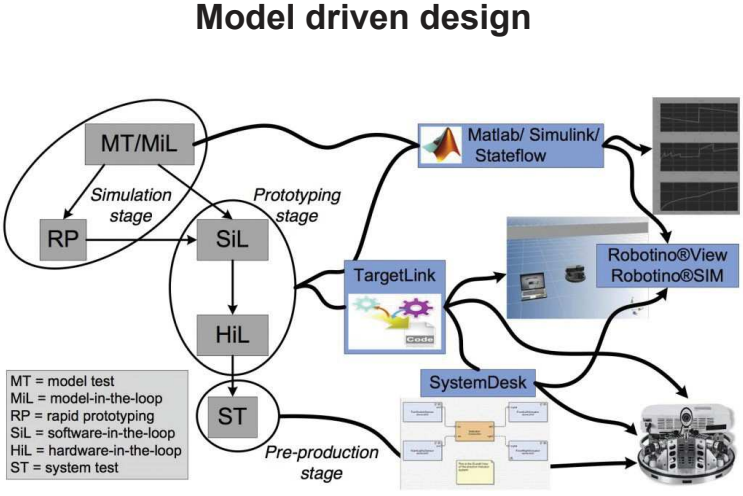


https://hcie.csail.mit.edu/research/laserfactory/laserfactory.html

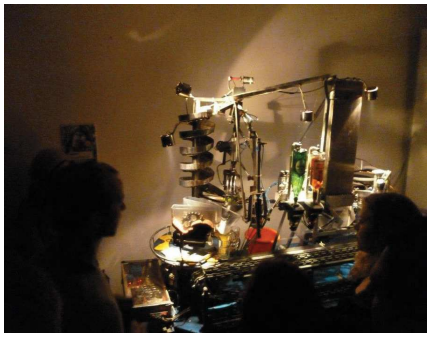
https://youtu.be/RzCAqVwZYCc



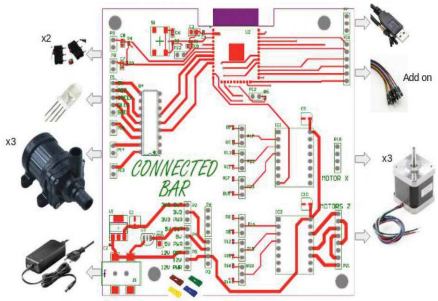




Projekty

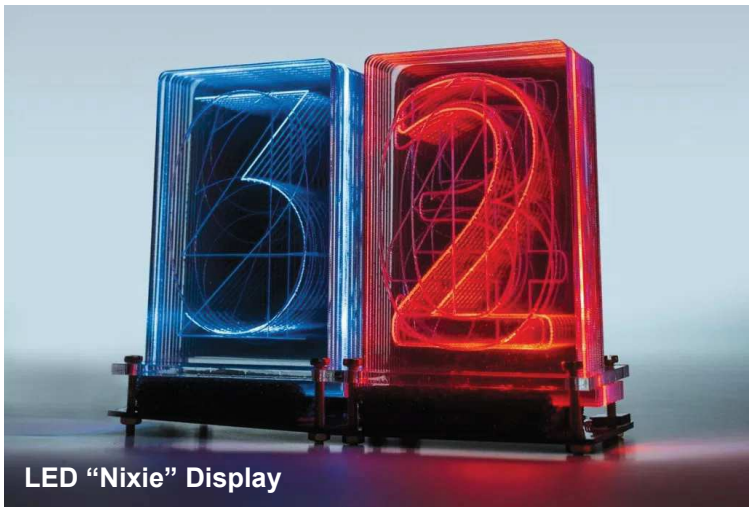


https://www.elektormagazine.com/labs/connected-cocktail-machine

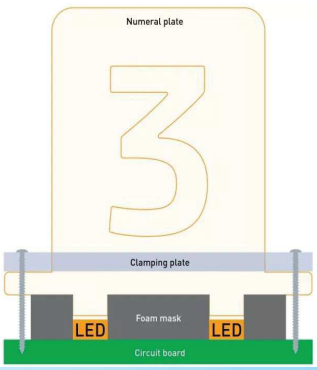


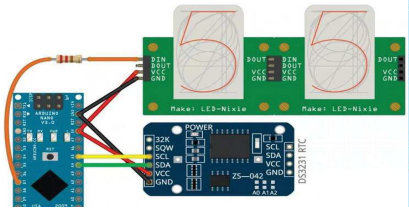
2. JSON table of cocktails

```
ktails": [{
   "cocktail": {
       "name": "sirop de menthe",
       "ingredients": [{
               "ingredient": {
                   "name": "menthe",
                   "measure": 1
               }
           },
           {
               "ingredient": {
                   "name": "eau",
                   "measure": 5
               }
           }
       ]
   }
, {
   ....
```

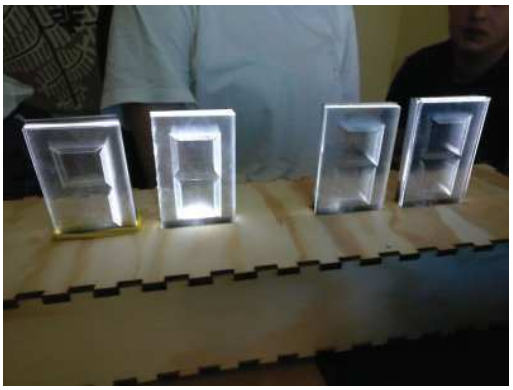


https://makezine.com/projects/led-nixie-display/

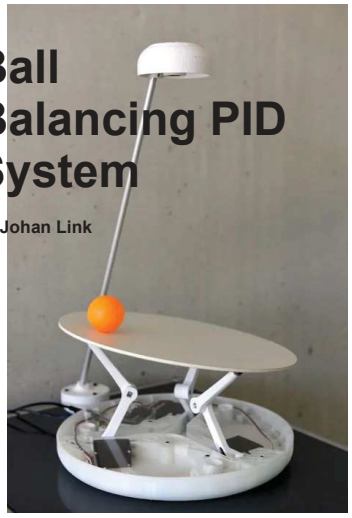


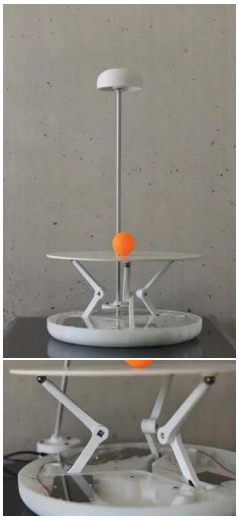



```
struct RGB {
  uint8_t red;
  uint8_t grn;
  uint8_t blu;
};

void OutDigit(uint8_t digit, uint8_t value, struct RGB* color) {
  pixels.setPixelColor((digit * 20) + (value * 2), pixels.Color(color->
  color->grn, color->blu));
  pixels.setPixelColor((digit * 20) + (value * 2) + 1, pixels.Color(col
  >red, color->grn, color->blu));
}

void OutNumber(uint16_t value, struct RGB* color, uint8_t leadingZero)
  uint8_t pos = 0;
  pixels.clear();   // clear all color values
```

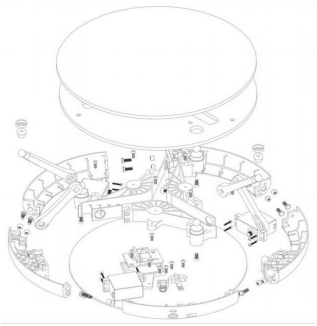


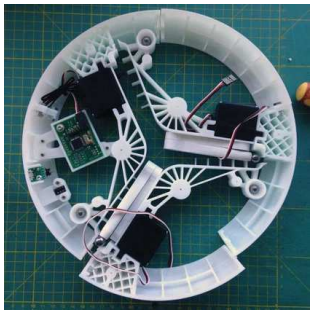
Adriána Selepová, Oliver Lachkovič

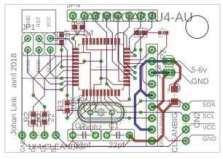


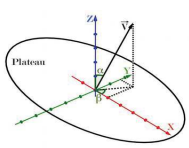


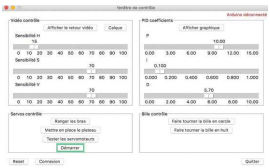
https://www.instructables.com/id/Ball-Balancing-PID-System/

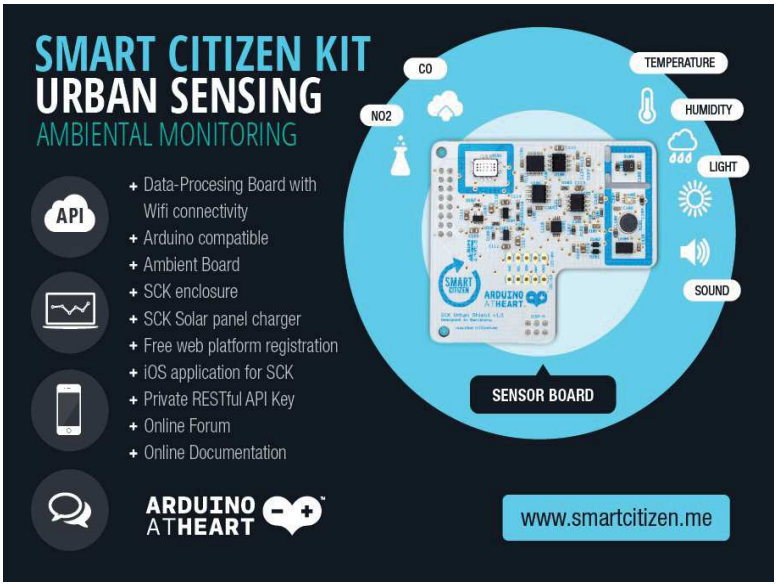


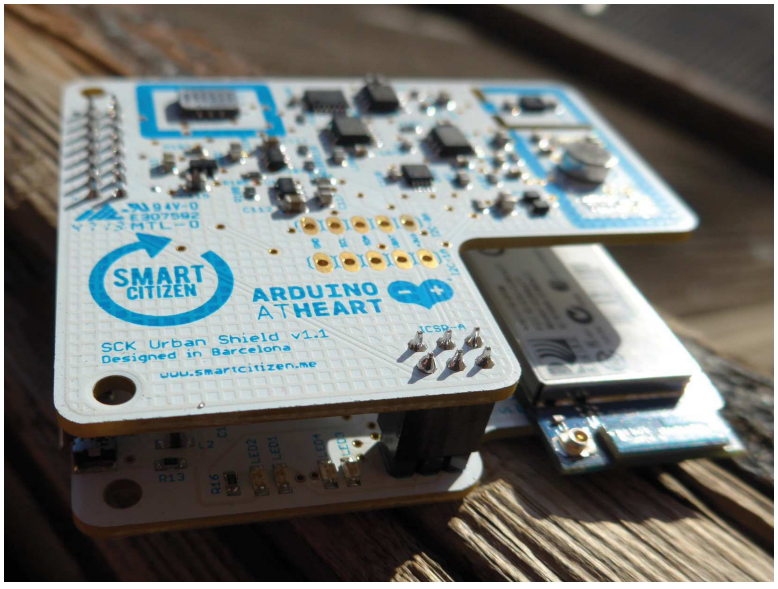


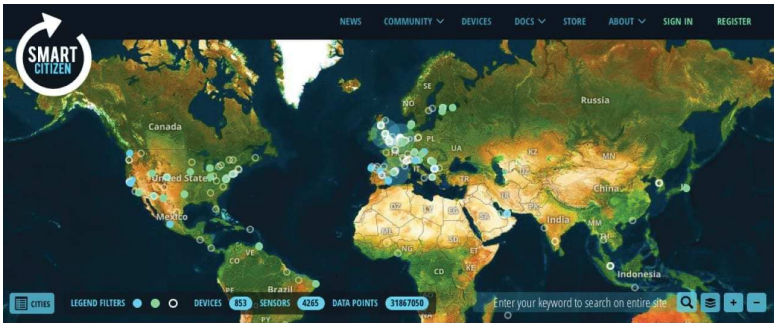


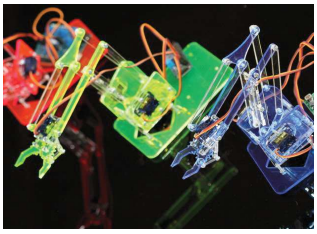






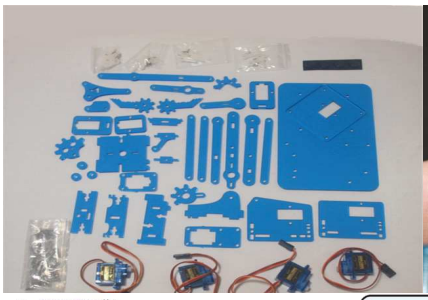


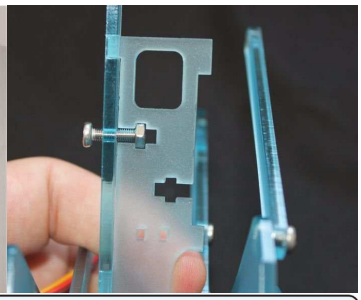




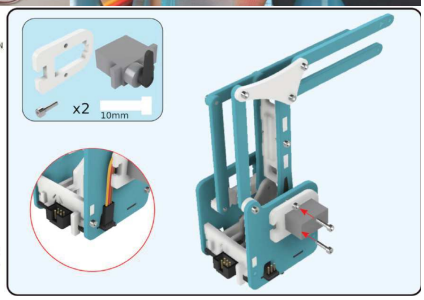
https://www.thingiverse.com/thing:298820

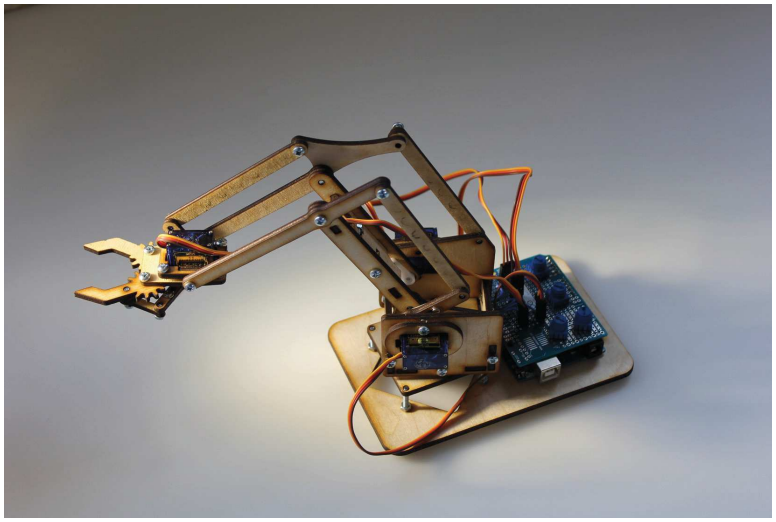
https://www.instructables.com/id/MeArm-Bu





```
MeArm::MeArm(){
  mainInstance = this;
  setServoPins(MEARM_DEFAULT_BASE_PIN, MEARM_DEFAULT_LOWER_PIN
  marcel.addCmd("moveJointsTo", _moveJointsTo, false);
  marcel.addCmd("moveBaseTo", _moveBaseTo, false);
  marcel.addCmd("moveLowerTo", _moveLowerTo, false);
  marcel.addCmd("moveUpperTo", _moveUpperTo, false);
  marcel.addCmd("moveGripTo", _moveGripTo, false);
  marcel.addCmd("openGrip", _openGrip, false);
  marcel.addCmd("closeGrip", _closeGrip, false);
  marcel.addCmd("getServoState", _getServoState, true);
  marcel.addCmd("version", _version, true);
  marcel.addCmd("pause", _empty, true);
  marcel.addCmd("resume", _empty, true);
  marcel.addCmd("stop", _empty, true);
#ifdef ESP8266
  marcel.addCmd("updateFirmware",   _updateFirmware,   true);
  marcel.addCmd("updateUI",         _updateUI,         true);
#endif //ESP8266
}
```

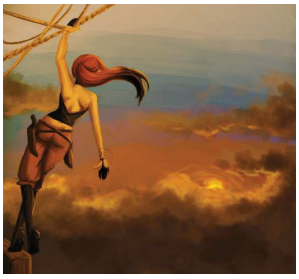




Wearable

Rekapitulácia

- P1: úvod
  - **C1: FabLab:** prehliadka a zoznámenie s priestormi
- **P2: elektronika (notebook)**
  - C2: FEI: schéma zapojenia a plošný spoj
- **noste si počítač**
- **myslite na projekt dňom i nocou**



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http://www.robotika.sk