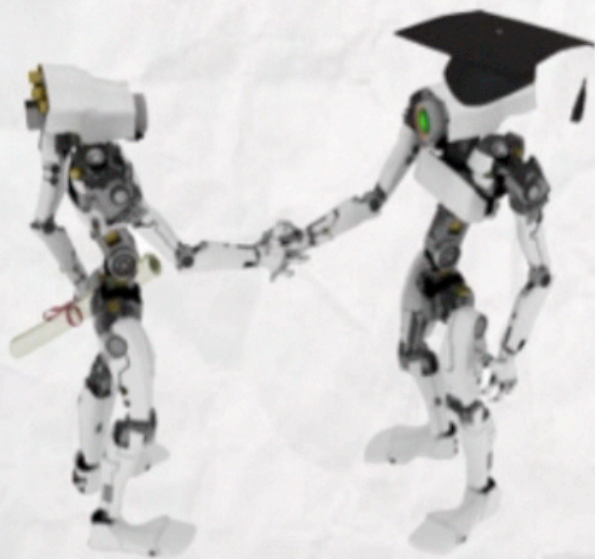


ROBOTICS IN EDUCATION

How to use robotics in the learning-by-doing approach



Davide Valeriani

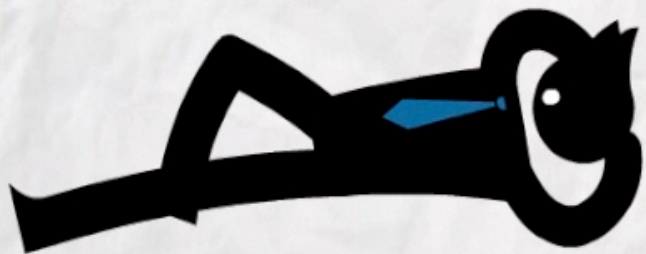
PhD Student

University of Essex



STUDENT'S OUTLINE

Useful for robotics
exam?



MY OUTLINE



- ✓ Why robotics?
- ✓ Robotics in different levels of Ed.
- ✓ A view to the future
- ✓ Conclusions

LEARNING'S CHALLENGE



Example isn't another way to teach, it is the only way to teach.

Albert Einstein

WHY ROBOTICS?

Robotics is **multidisciplinary**

- Computer science
- Electronics
- Mechanical Engineering
- Control



LEVELS OF EDUCATION



University



High School



Primary and Middle School

LET'S START...



...BUT NOT TOO EARLY!



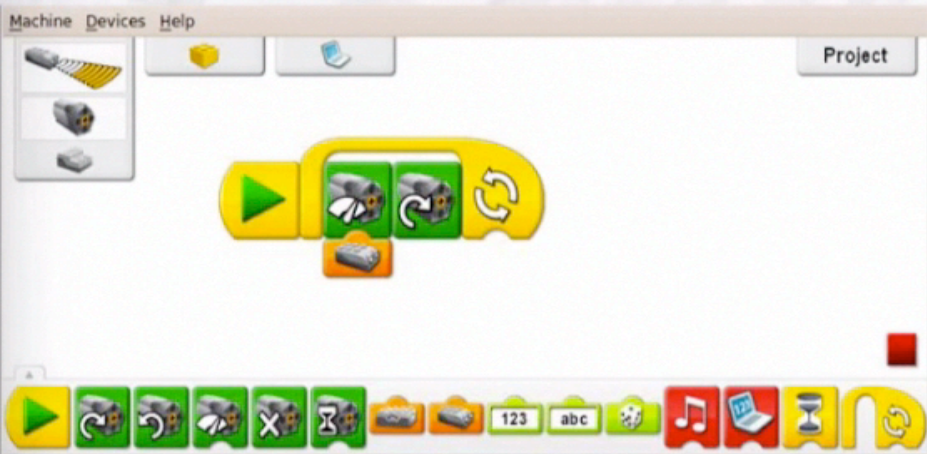
PRIMARY AND MIDDLE

- ➔ Built a Star Wars city as a backdrop
- ➔ Wrote stories about robot and human
- ➔ Developed the story using instructions (i.e. move forward)
- ➔ Program the robot with teacher



Valiant Roamer
(280 \$)

OR... LEGO WEDO!



BEST APPROACH?



KIT-BASED

CURRICULAR



OLD AND YOUNG

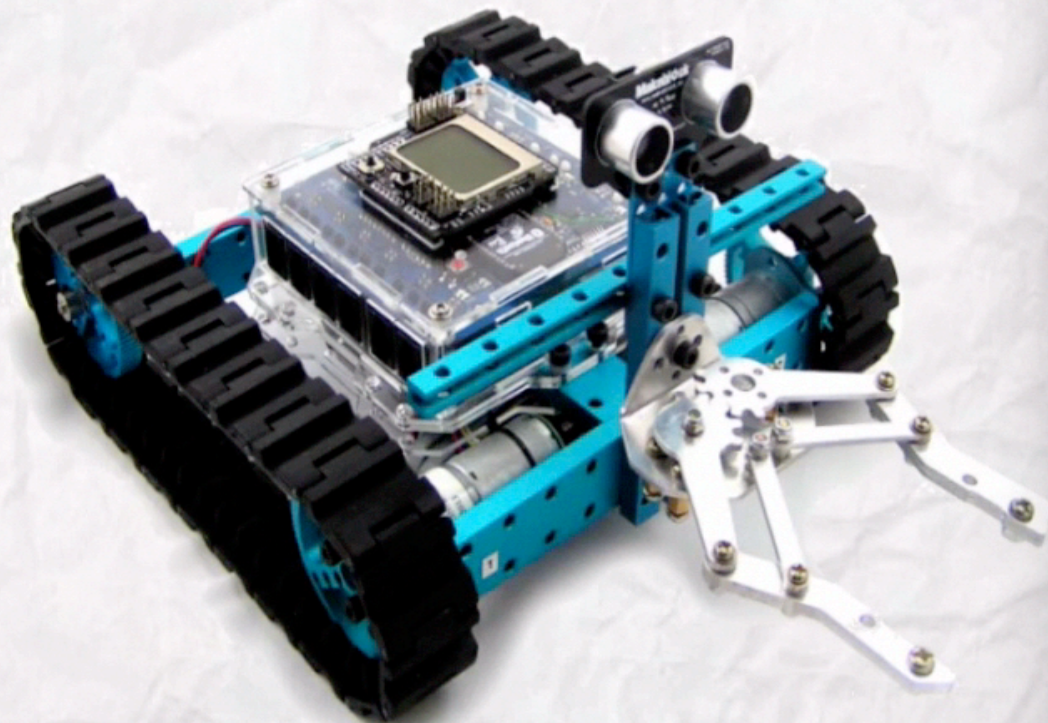
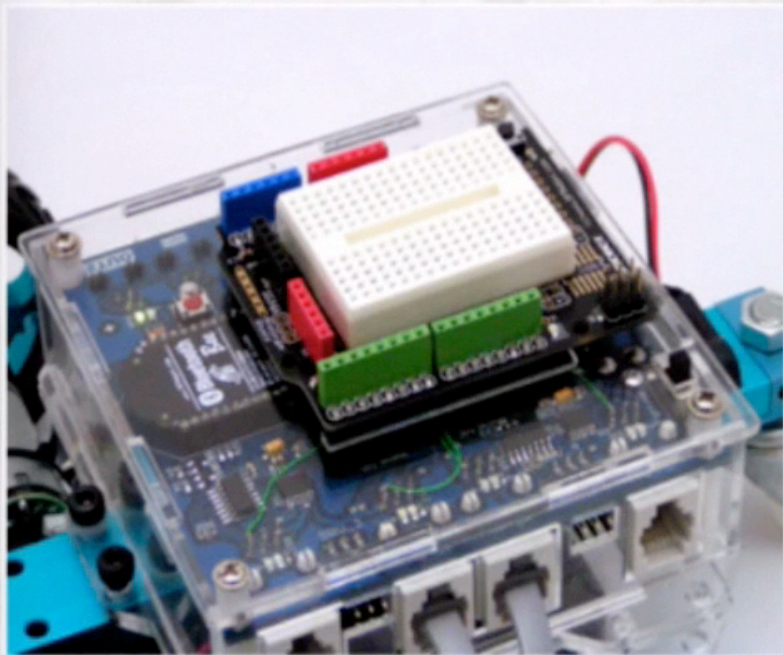
Cross-generational project to introduce pupils and senior citizens to science and technology.



HIGH SCHOOL

- Humanistic competencies higher than technical ones
- Introduce Mechatronics to gymnasium
- Ad-hoc kit with professional components
- Several programming languages available (C++, Prophio, Scratch)

RESULTS



DIFFERENT SKILLS

- Time management
- Team work
- Prototyping
- Robotics





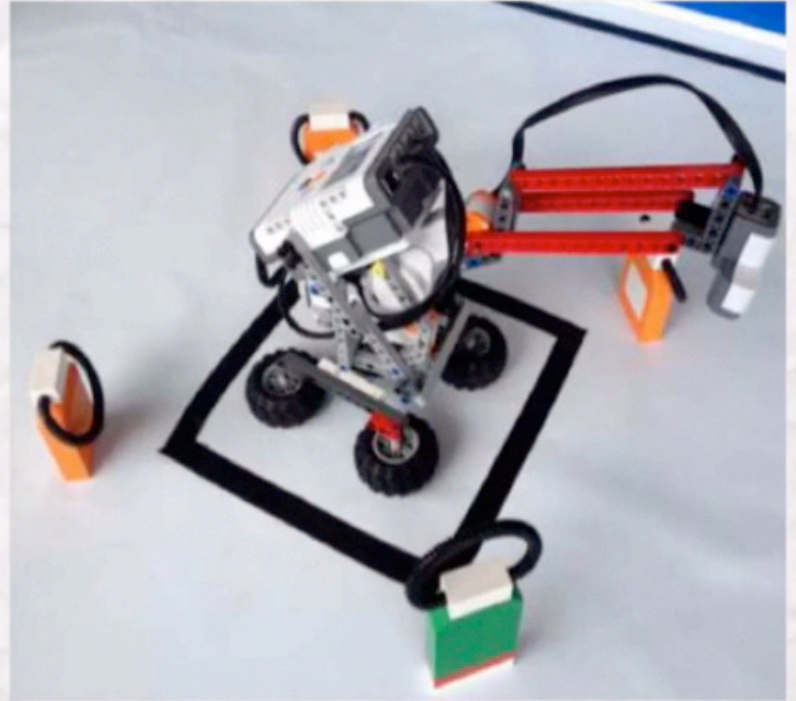
ENTREPRENEURSHIP

- Security alarm for a steam generator
- Mobile traffic light for public works
- Control of a pumping station
- Piano 3.0 simulation



ROBOTICS PROJECT

Automated line for
filling, packing and
palletizing bottles
of wine



CVARC SIMULATOR

System for online competitions on virtual robots' control

WWW.AIR-LABS.RU

```
<World>  
<Box X="100" Y="100" Z="25"  
Width="50" Height="50" Length="50">  
  <Box.Left>  
    <ColoredSurface Color="Red"/>  
  </Box.Left>  
</Box>  
</World>
```

UNIVERSITY

Robotics + Design class @ PoliMI

- ✓ Facilitate students to speak easy
- ✓ Competition with beautiful robots
- ✓ Learning by doing useful also in design

PROJECT MANAGEMENT

Modified Extreme Programming and Scrum (Agile) methodology applied to robotics:

- ✓ Pair programming
- ✓ Regular meetings
- ✓ Work packages
- ✓ Ticket system

OVERVIEW OF TECHNOLOGIES

Building robots: project-based learning

- ✓ Complete robotics kits
- ✓ Build from scratch

COMPLETE ROBOTICS KITS

- ✓ Simple: good entry point
- ✗ Expensive
- ✗ Hard use with other components

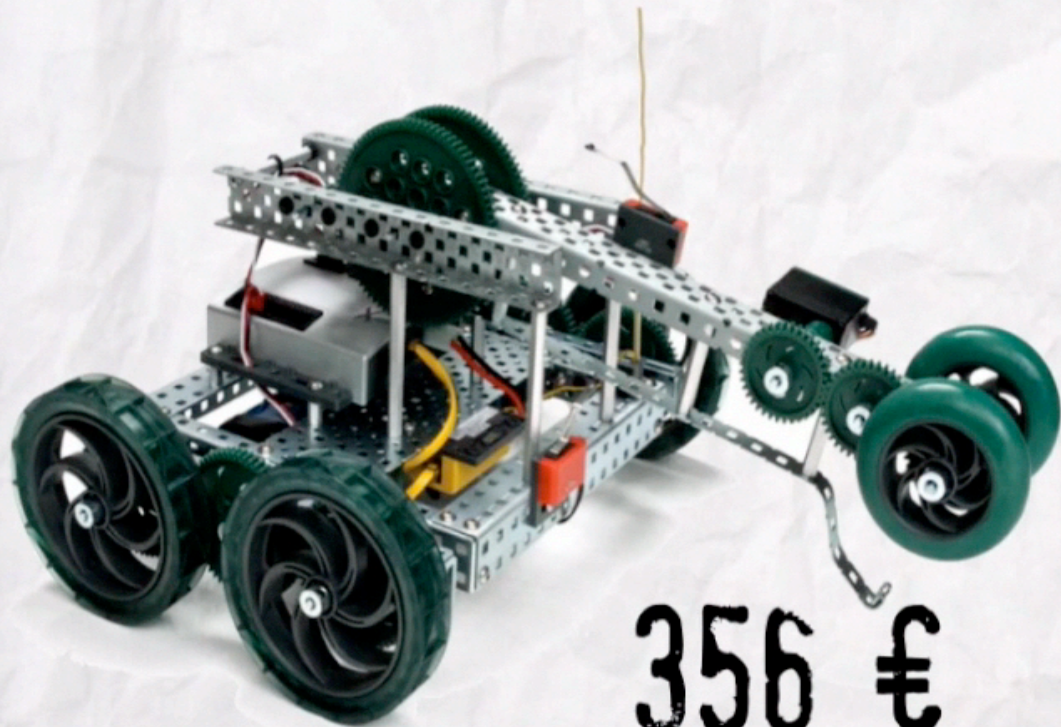
LEGO MINDSTORMS



330 €



VEX



356 €

Professional

PIC or Cortex

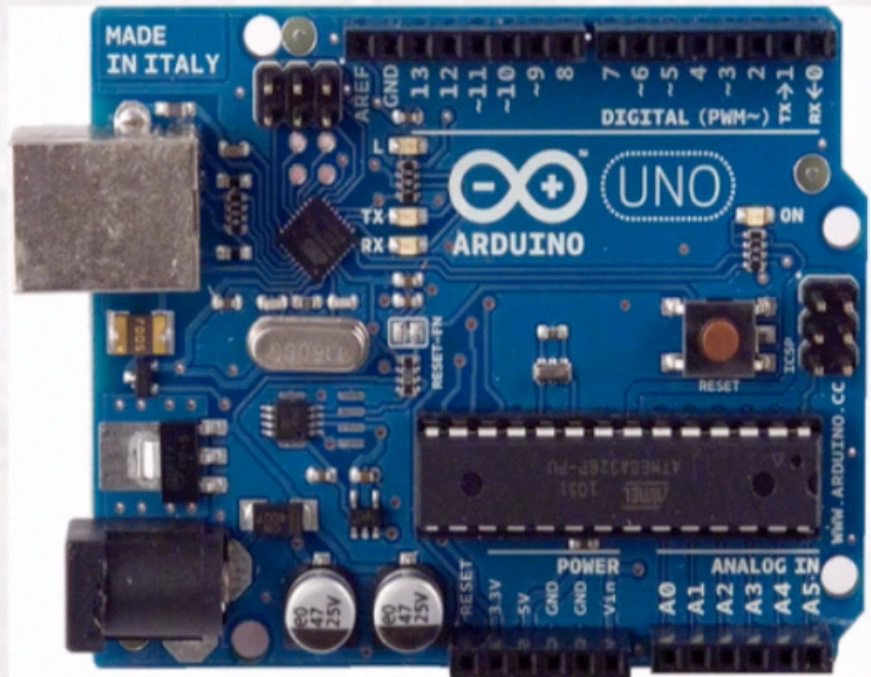
Written code

ARDUINO

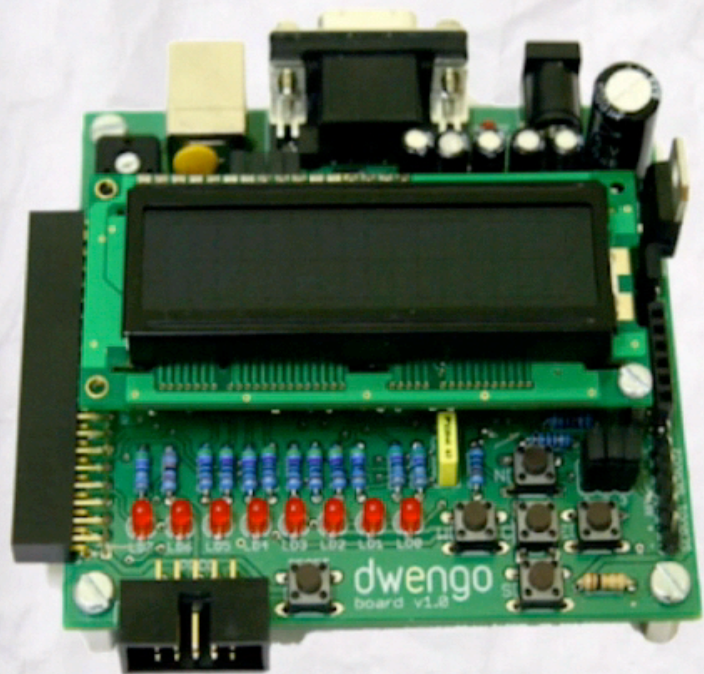
Big community

Require skills

Low cost 18 €



DWENGO

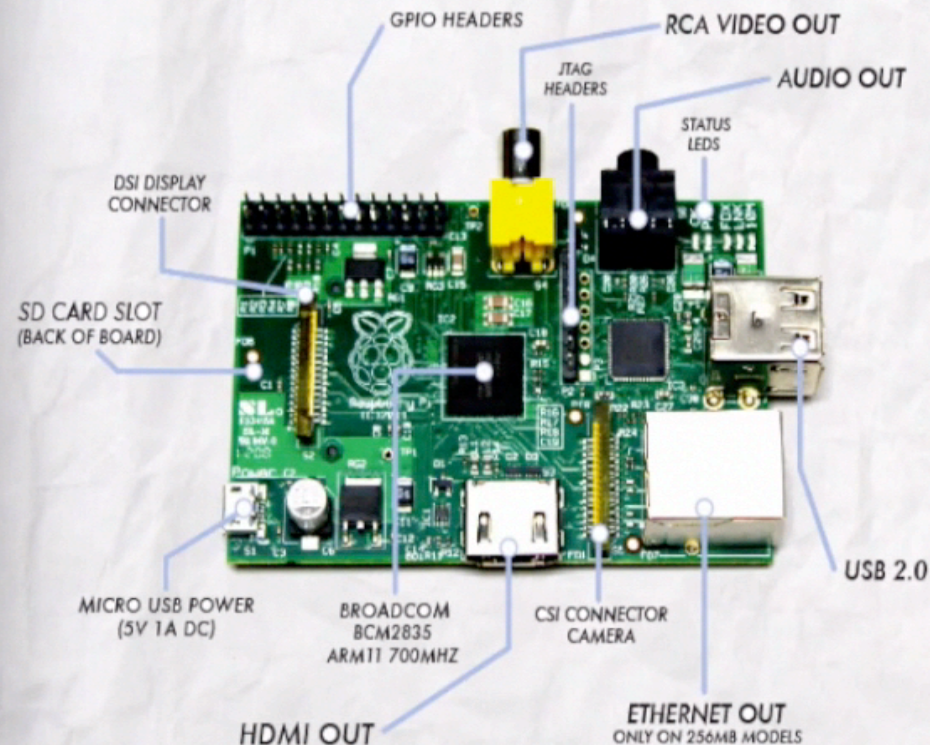


PIC chip

Robotics-oriented

65 €

RASPBERRY PI



Small computer

OS overhead

25 \$

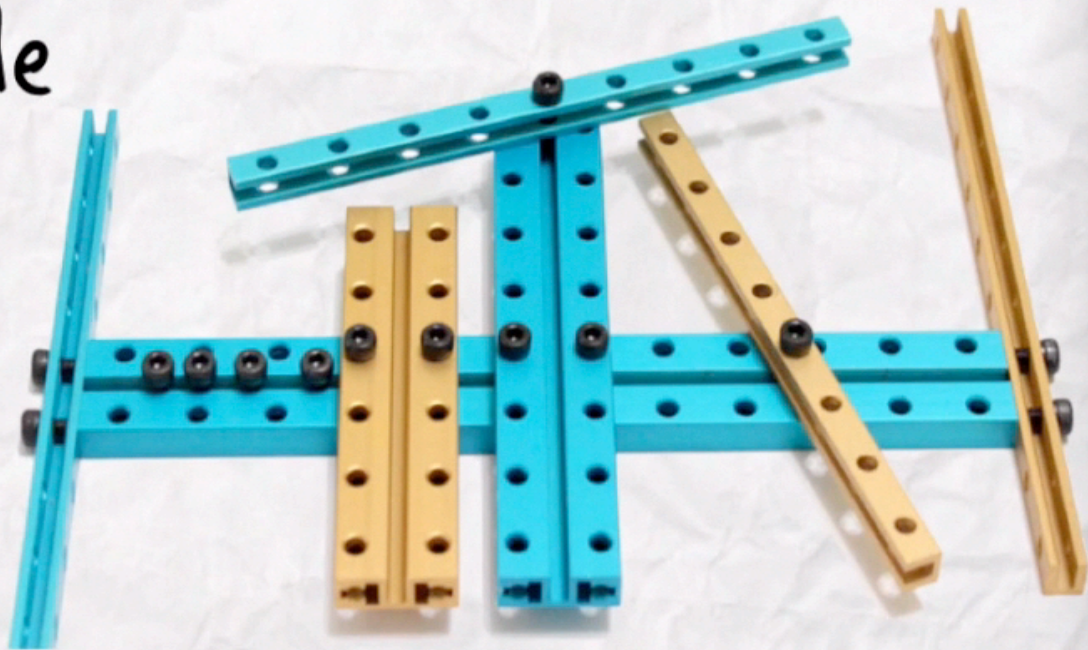
Powerful

MAKEBLOCK

Lego compatible

Aluminium

Expensive



OPENBEAM

Third-part components compatible

Standard M3 nuts and bolts

Open hardware



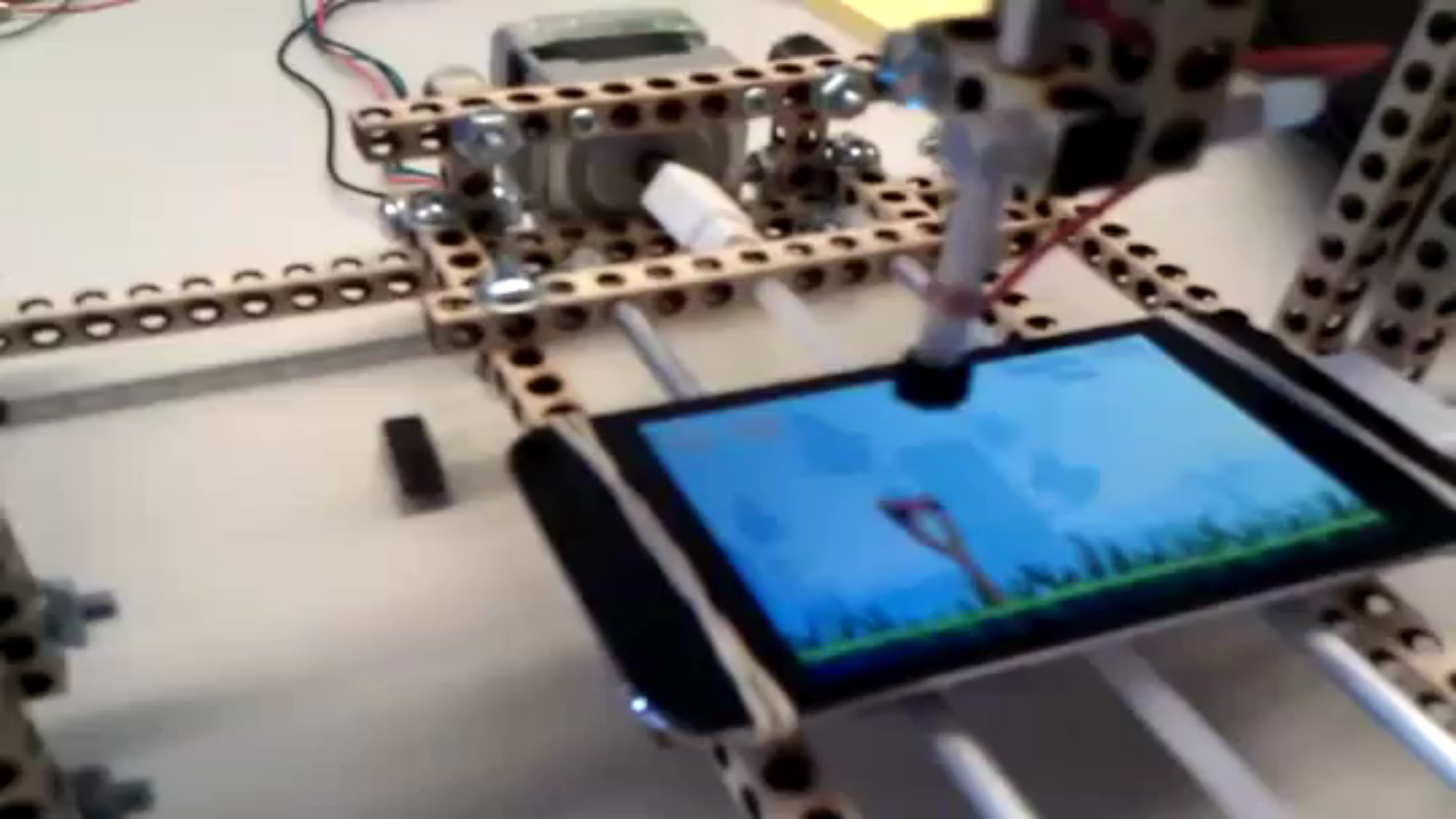
BITBEAM

Lego compatible

Cheap

3D printable





PROGRAMMING LANGUAGES

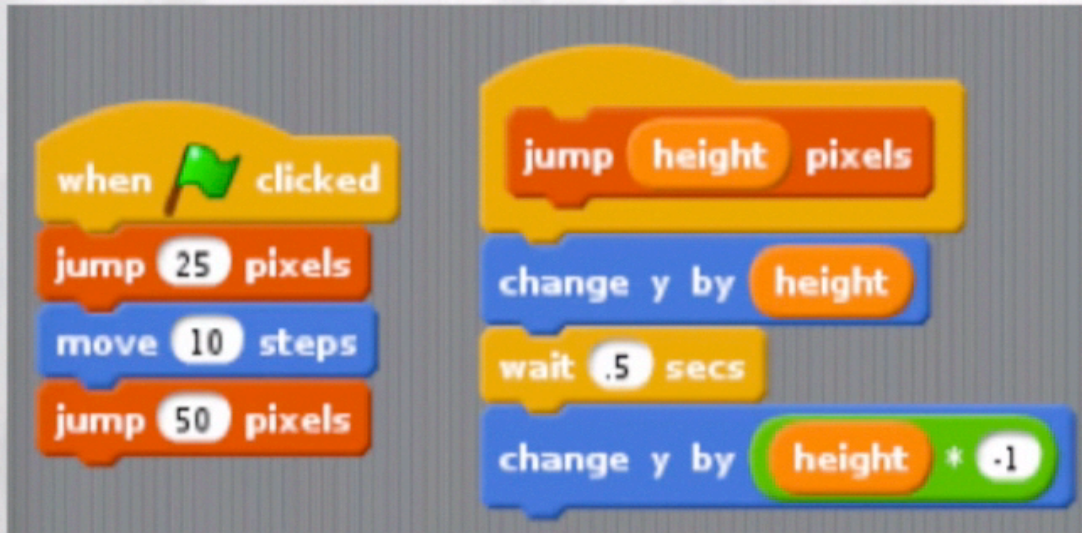


Low level



Graphical

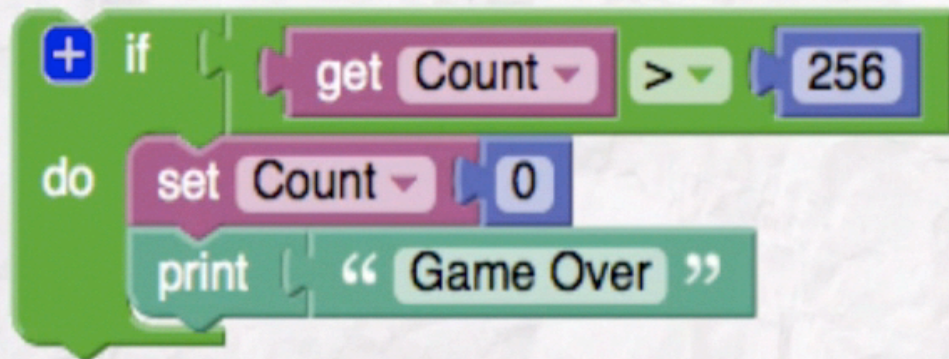
SCRATCH



Puzzle-like GUI

Used to learn
programming

GOOGLE BLOCKLY

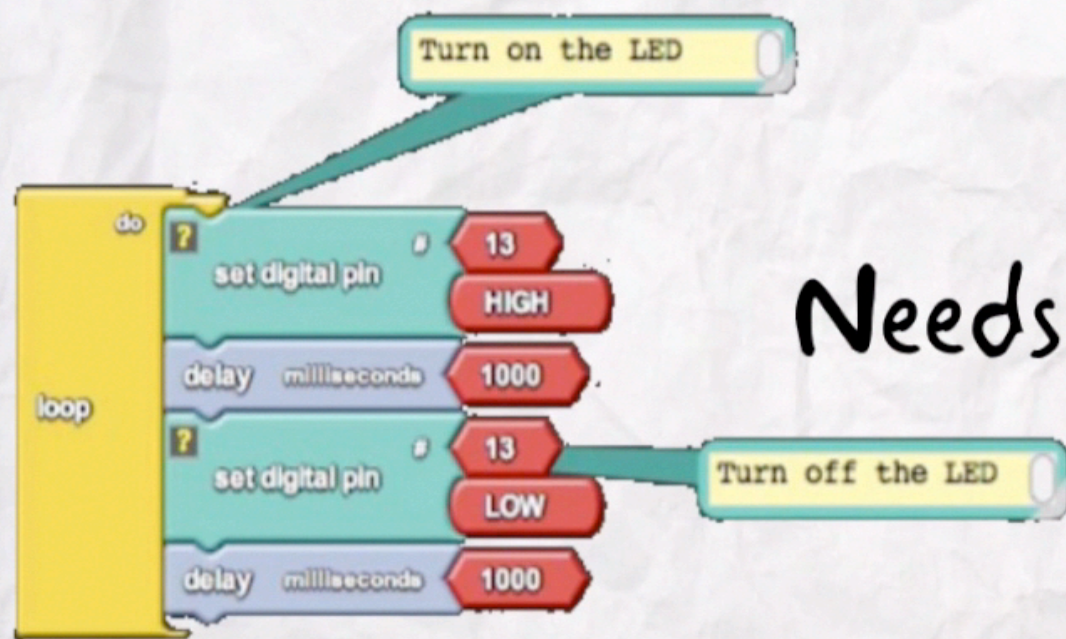


Language GUI

Used for design

JavaScript and Python converter

ARDUBLOCK



Arduino GUI

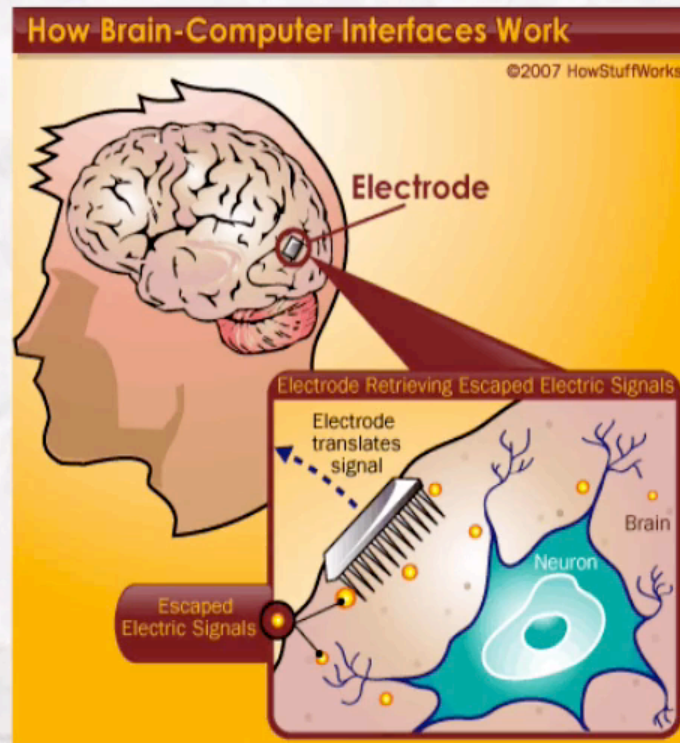
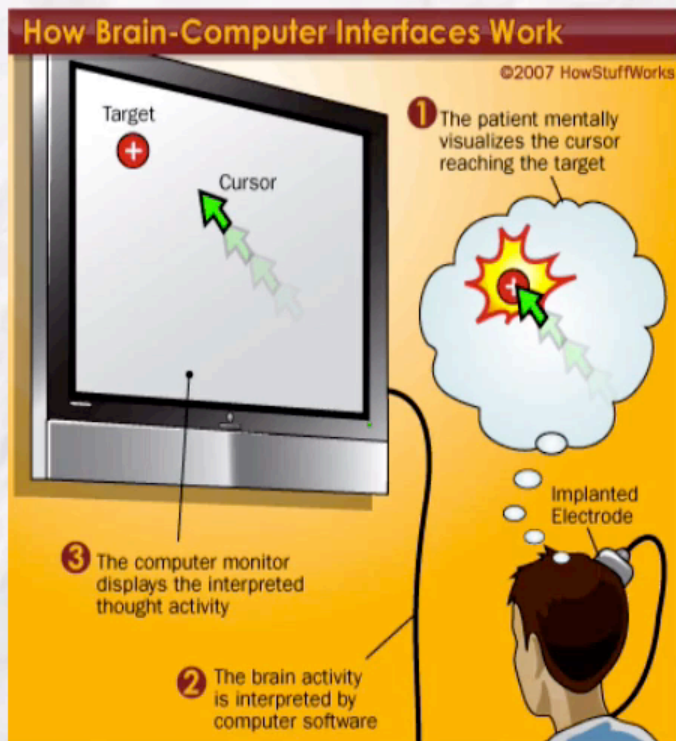
Needs improvement

Educative

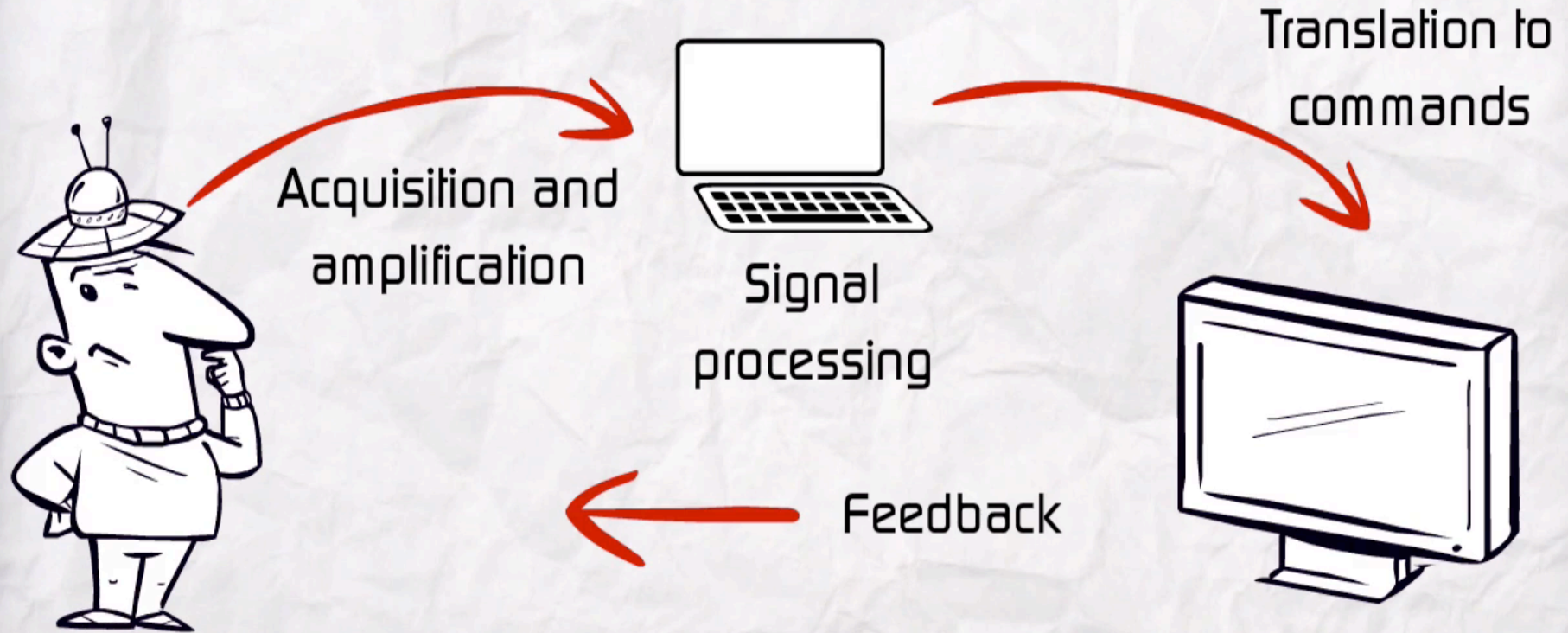
A VIEW TO THE FUTURE



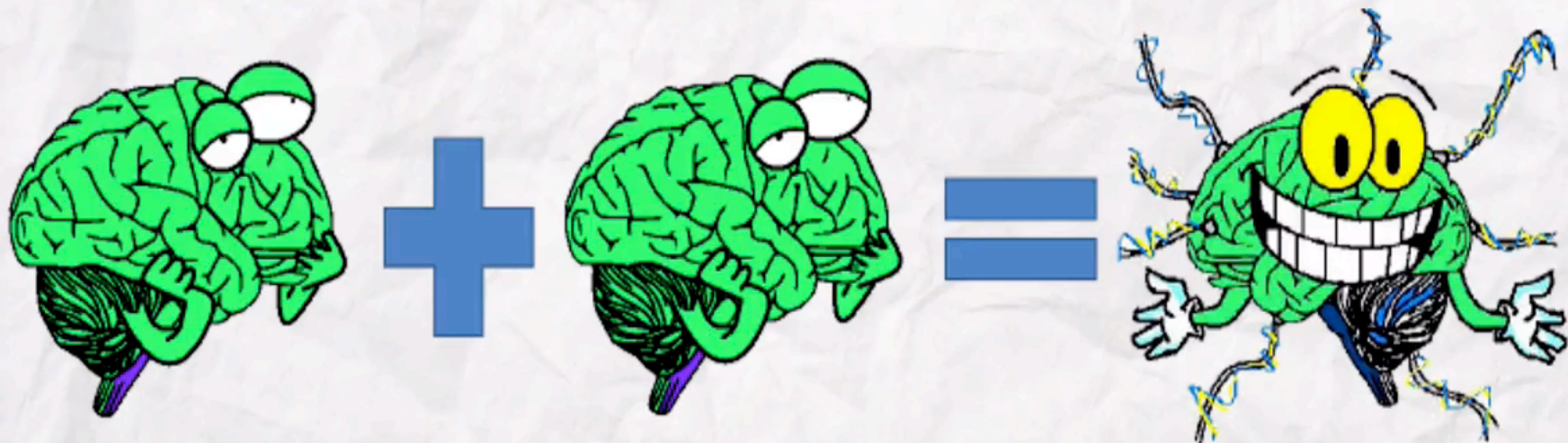
BRAIN COMPUTER INTERFACE



BRAIN COMPUTER INTERFACE



COLLABORATIVE BCI



RY
TH YOU



TOGETHER
WE CAN END THIS WAR
WE'RE COUNTING ON YOU TO HELP US TO VICTORY
THE SUCCESS OF THE PAN PACIFIC DEFENSE CORPS AGAINST THE KAUU DEPENDS ON YOU.
OUR ENEMIES ARE UNLIKE ANY WE'VE ENCOUNTERED BEFORE. HELP US BEAT THEM.

CONCLUSIONS



OPEN YOUR MIND



