Inventing…

with Software and Electronics

Hi

Scott Libert

Scott Libert

Sr. Software Engineer

Scott Libert
Control System Mentor

Kauaibots
Team 2465

Kauai Innovation Labs

Invent. Build. Learn. Repeat...

Scott Libert

The Big Cheese

Do you like to invent things?

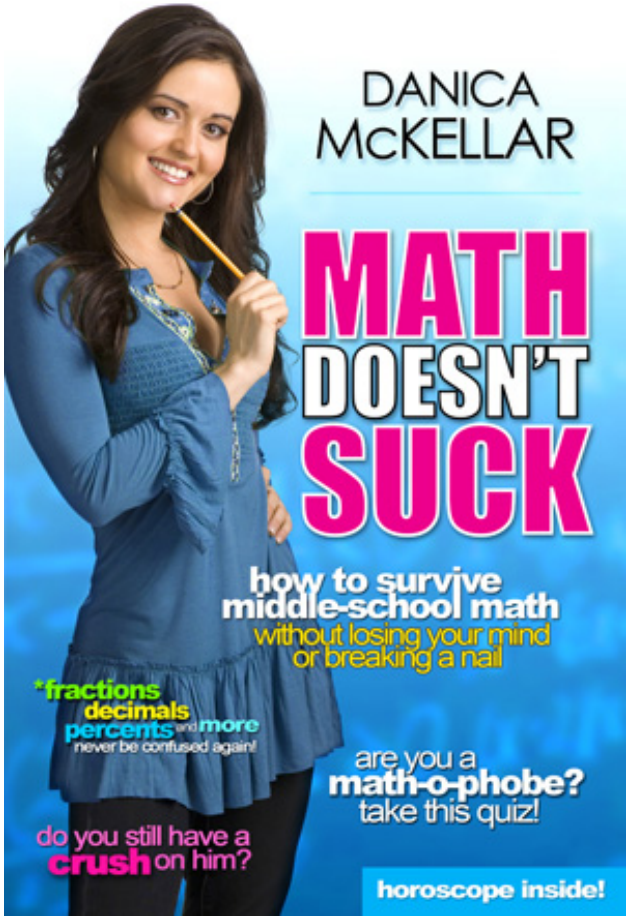
Do you like to figure out how stuff works?

Do you like to solve problems?

Do you like to sit in front of a computer?

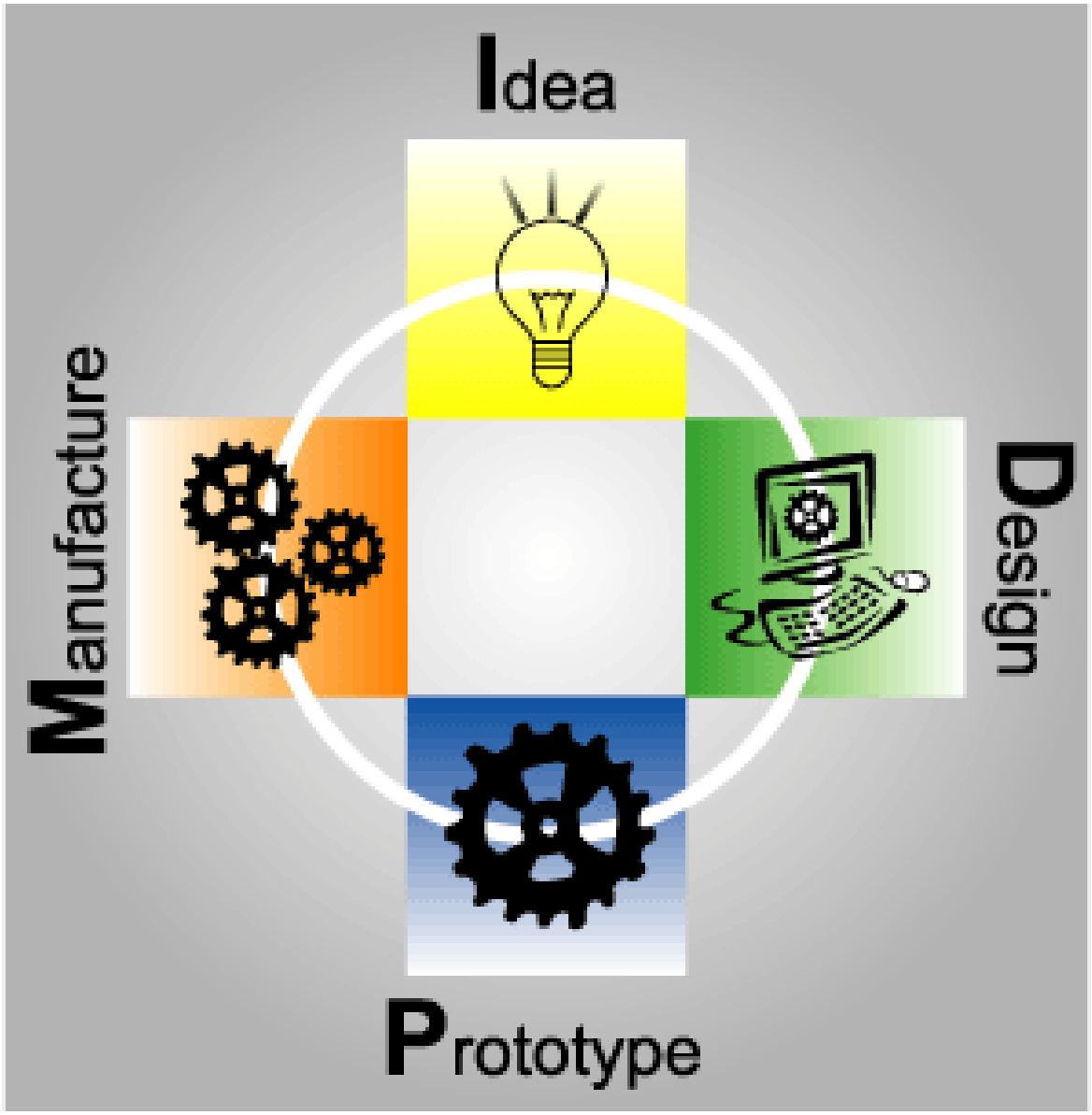
Do you like to design stuff?

(P.S.: Some math required…)



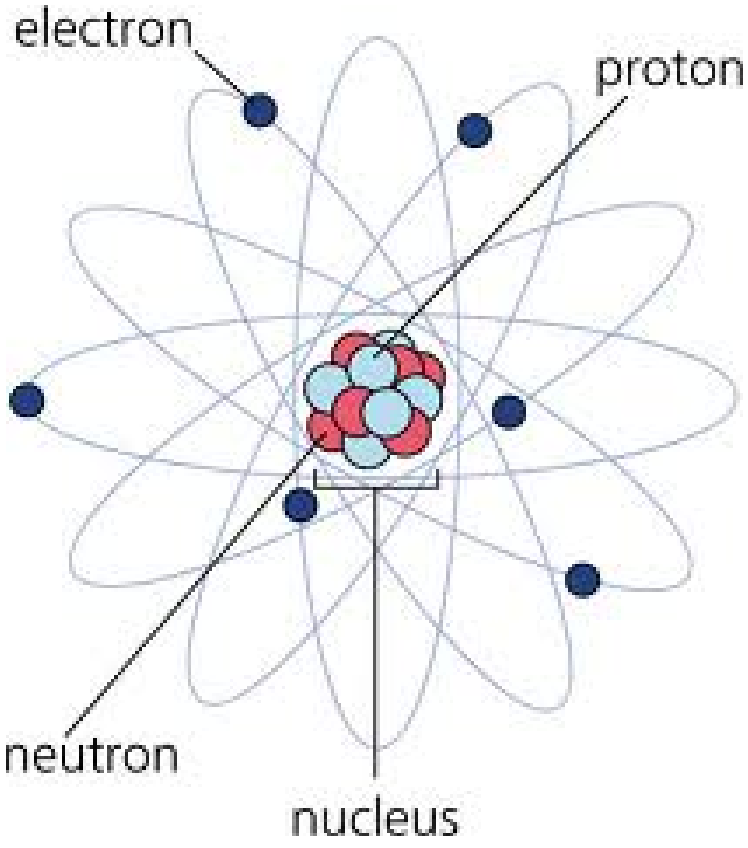
Invention

a unique or novel ***device****, method, composition or* process.

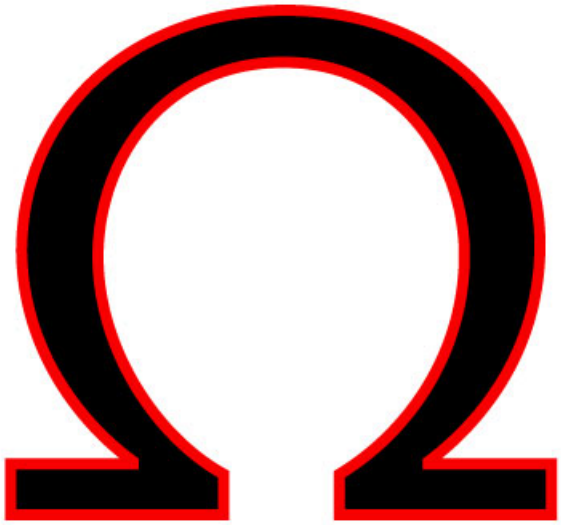

Idea
Design
Prototype
Manufacture

Electronics

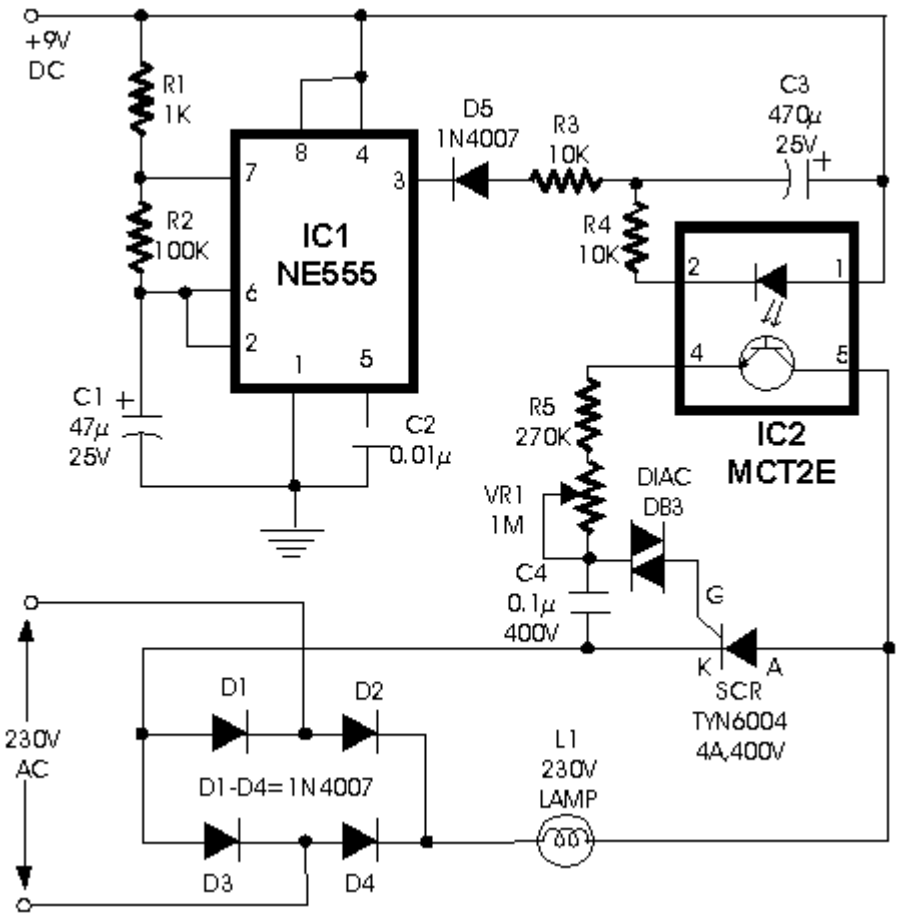
the branch of physics, engineering and technology dealing with electrical circuits



ELECTRONS



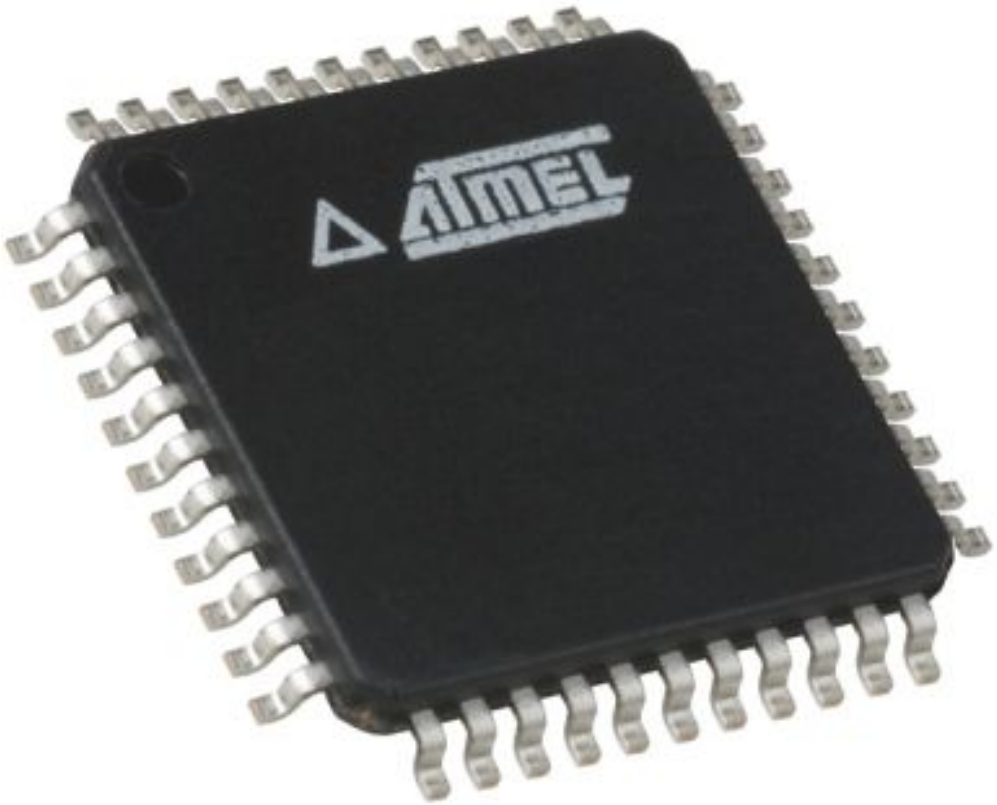
ELECTRICAL LAWS


+9V
DC
R1
1K
R2
100K
IC1
NE555
8
4
7
3
6
2
1
5
C1
47µ
25V
C2
0.01µ
D5
1N4007
R3
10K
C3
470µ
25V
R4
10K
IC2
MCT2E
2
1
4
5
R5
270K
VR1
1M
DIAC
DB3
C4
0.1µ
400V
G
K
A
SCR
TYN6004
4A,400V
230V
AC
D1
D2
D1-D4=1N4007
D3
D4
L1
230V
LAMP

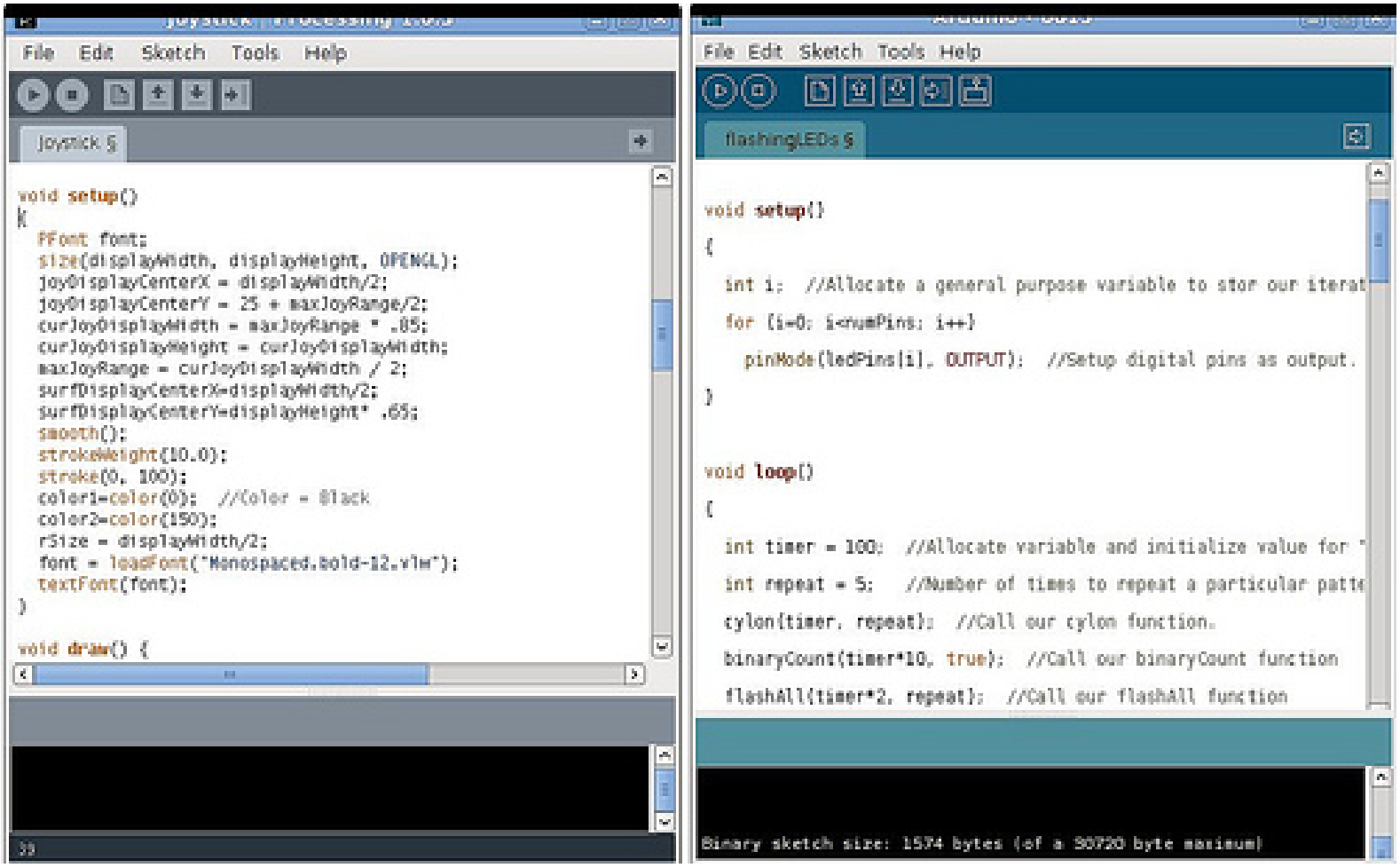
CIRCUITS

Software

instructions telling a computer what to do and how to do it



Microcontroller (MCU)


File Edit Sketch Tools Help
Joystick §
void setup()
{
PFont font;
size(displayWidth, displayHeight, OPENGL);
joyDisplayCenterX = displayWidth/2;
joyDisplayCenterY = 25 + maxJoyRange/2;
curJoyDisplayWidth = maxJoyRange * .85;
curJoyDisplayHeight = curJoyDisplayWidth;
maxJoyRange = curJoyDisplayWidth / 2;
surfDisplayCenterX=displayWidth/2;
surfDisplayCenterY=displayHeight* .65;
smooth();
strokeWeight(10.0);
stroke(0, 100);
color1=color(0); //Color = Black
color2=color(150);
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void loop()
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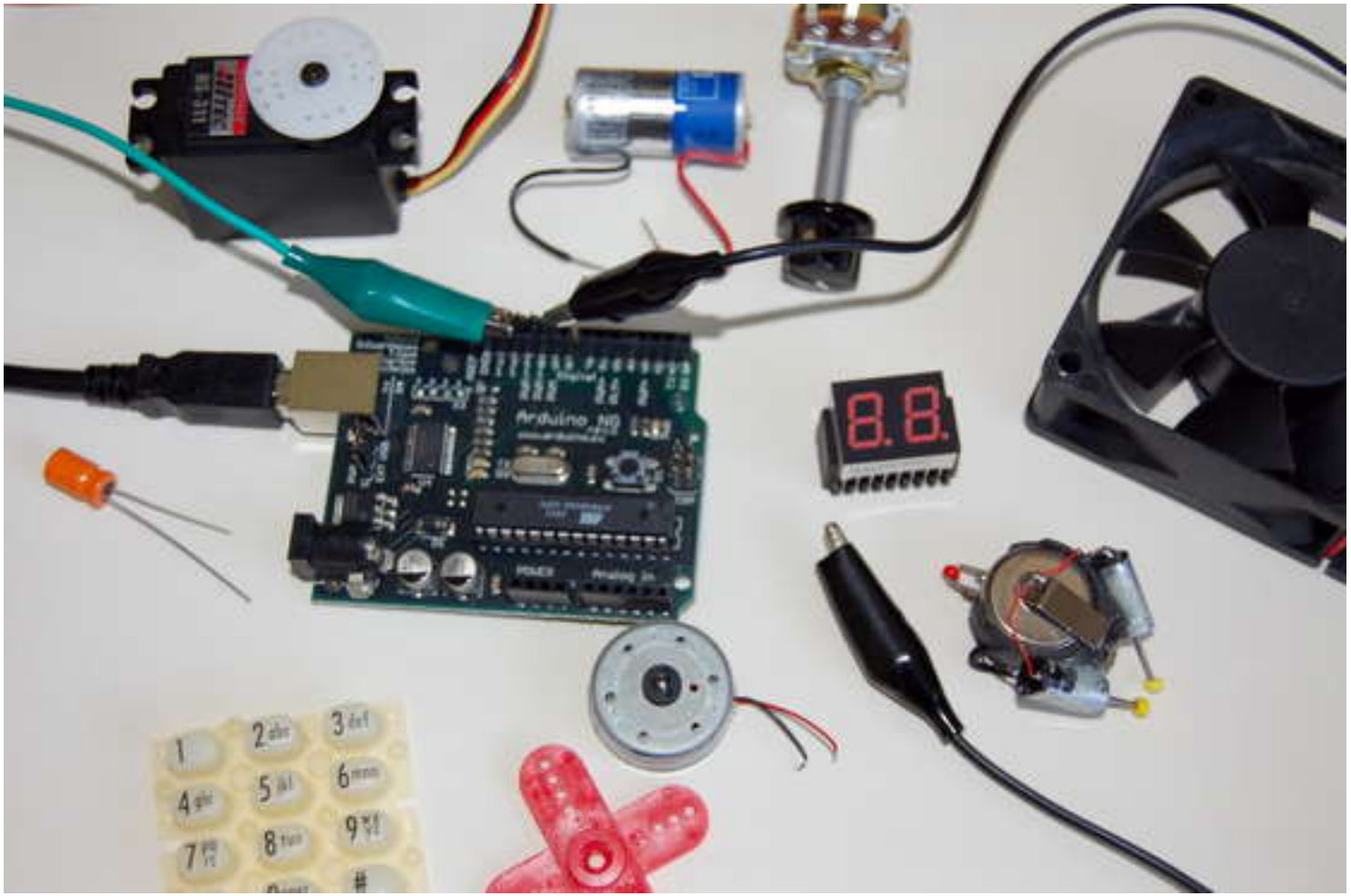
int timer = 100; //Allocate variable and initialize value for "
int repeat = 5; //Number of times to repeat a particular patte
cylon(timer, repeat); //Call our cylon function.
binaryCount(timer*10, true); //Call our binaryCount function
flashAll(timer*2, repeat); //Call our flashAll function
Binary sketch size: 1574 bytes (of a 30720 byte maximum)

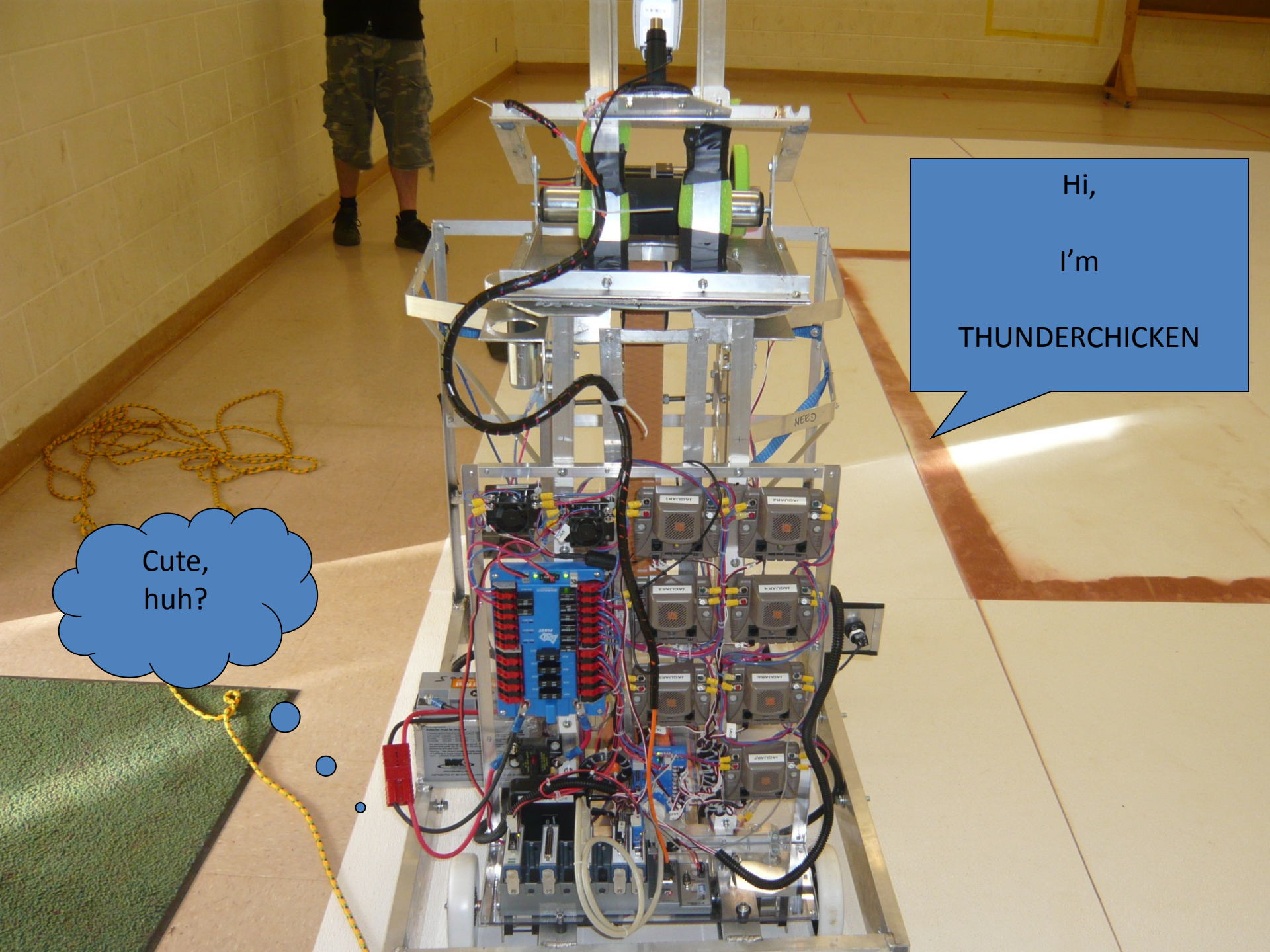
Code

I was born to code…

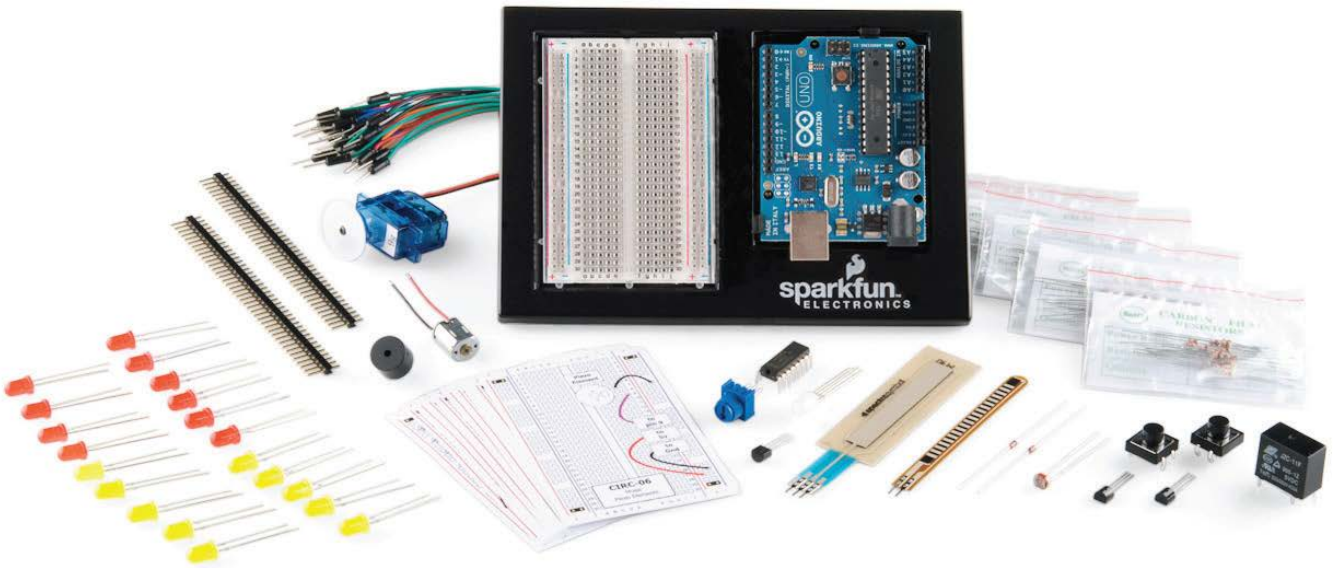
Physical Computing


Arduino
8.8.
1
2 abc
3 def
4 ghi
5 jkl
6 mno
7 pqrs
8 tuv
9 wxyz
#

Every
1234567890 12
MRC M− M+ +/− MU GT
7 8 9 % √
EX 4 5 6 × ÷
CE 1 2 3 −
ON AC 0 00 • +
=
waterpik
ONKYO
iPod 9:42 AM
Top Tens
iTunes
Top Songs
Top Albums
Tap to Preview, Double-Tap to View Album
1. Say It Right
2. Bubbly
3. Stronger
4. Makes Me Wonder
$0.99
Featured
Top Tens
Search
Downloads
Canon
USA
NASA


Hi,
I'm
THUNDERCHICKEN
Cute,
huh?

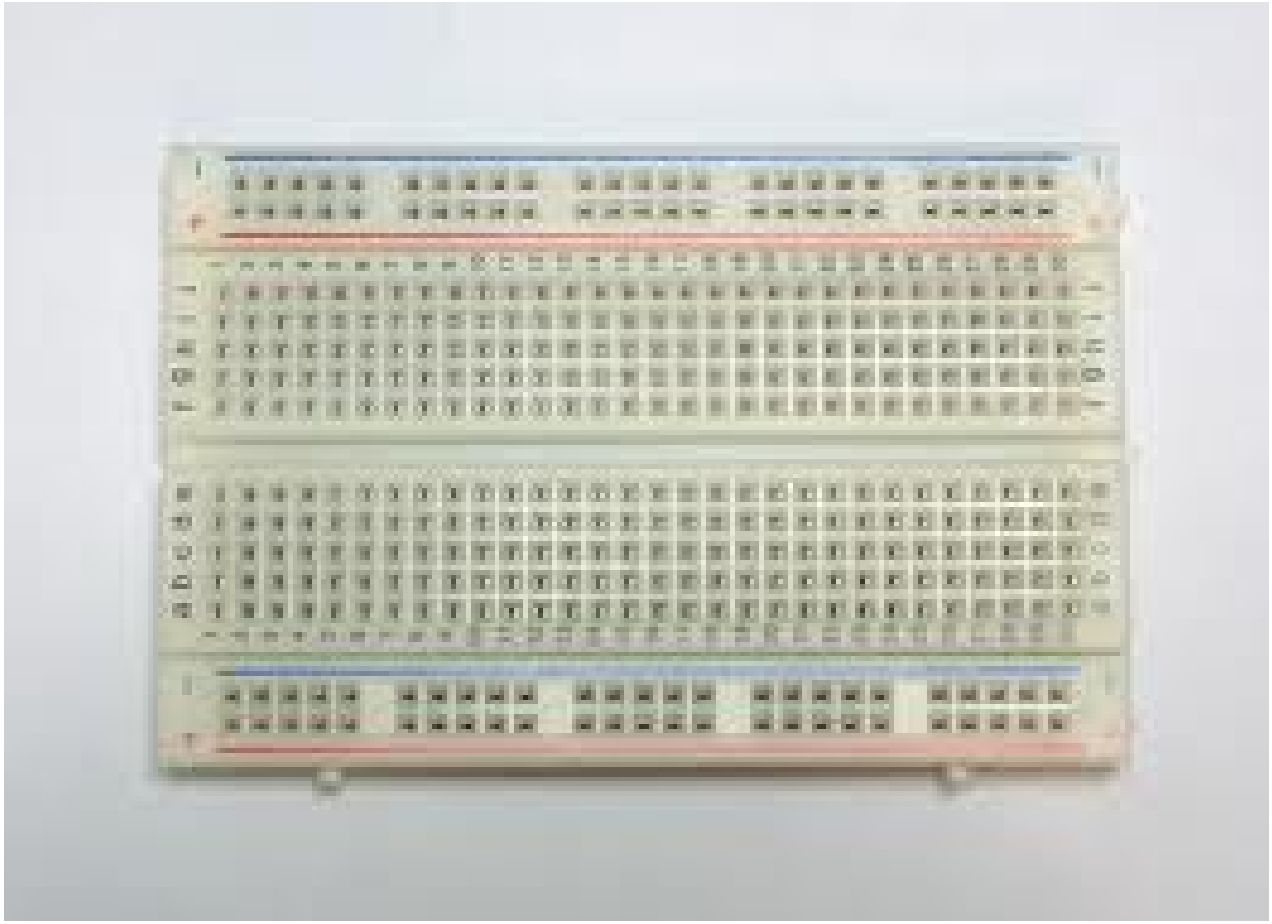
Your Inventor's Kit



What's in the box……

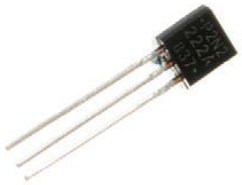
Arduino

Breadboard



Electrical Components

- Battery
- Fundamental Components
  - Resistor
  - Capacitor*
  - Inductor*
  - <Memristor – new kid on the block>**
- Compound Components
  - Diode
  - Transistor



Sensors

<Measure the Physical World>

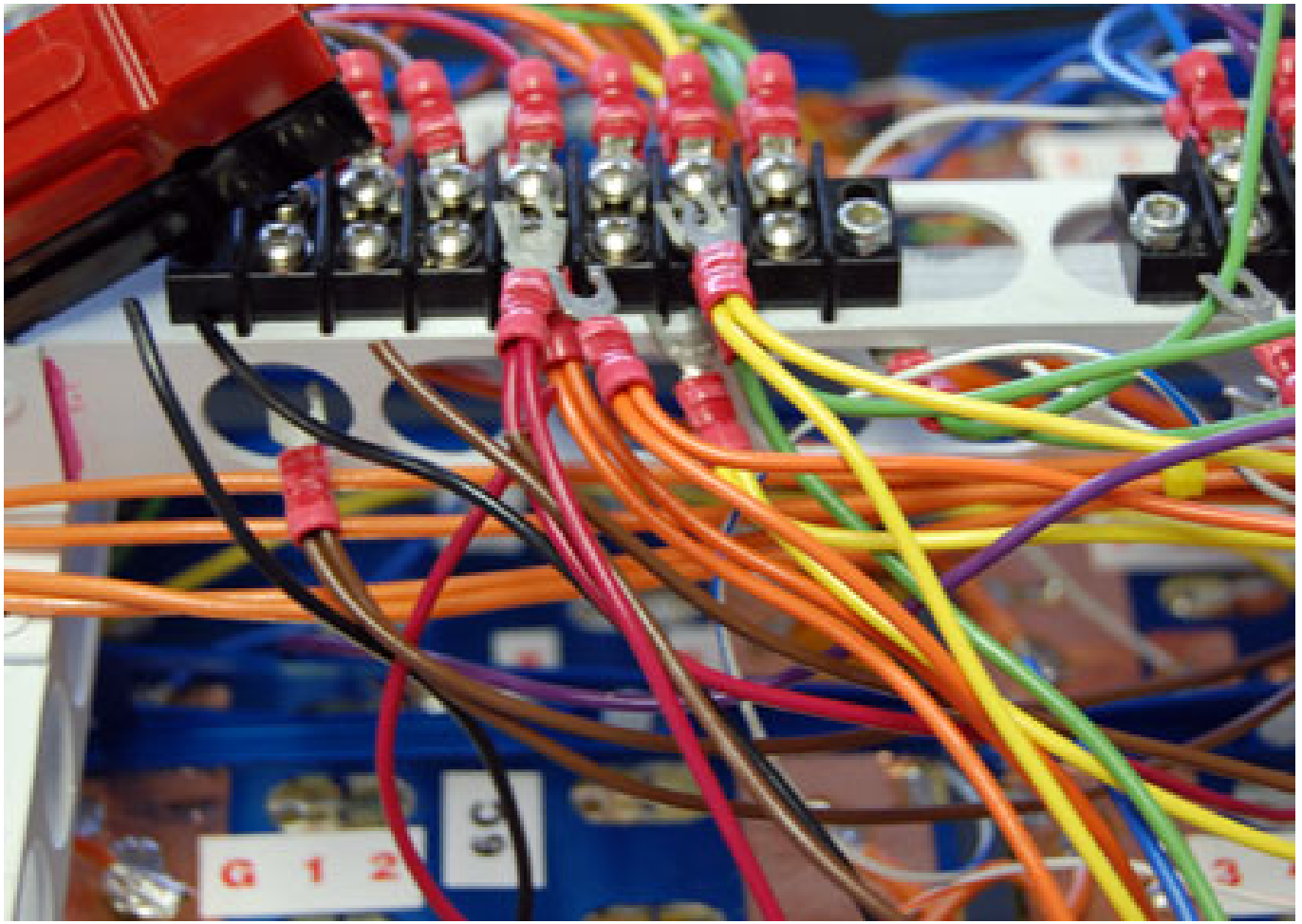
Gravity	Temperature
Light	Pressure
Acceleration	Magnetic Fields
Chemical Composition	Mass

Actuators

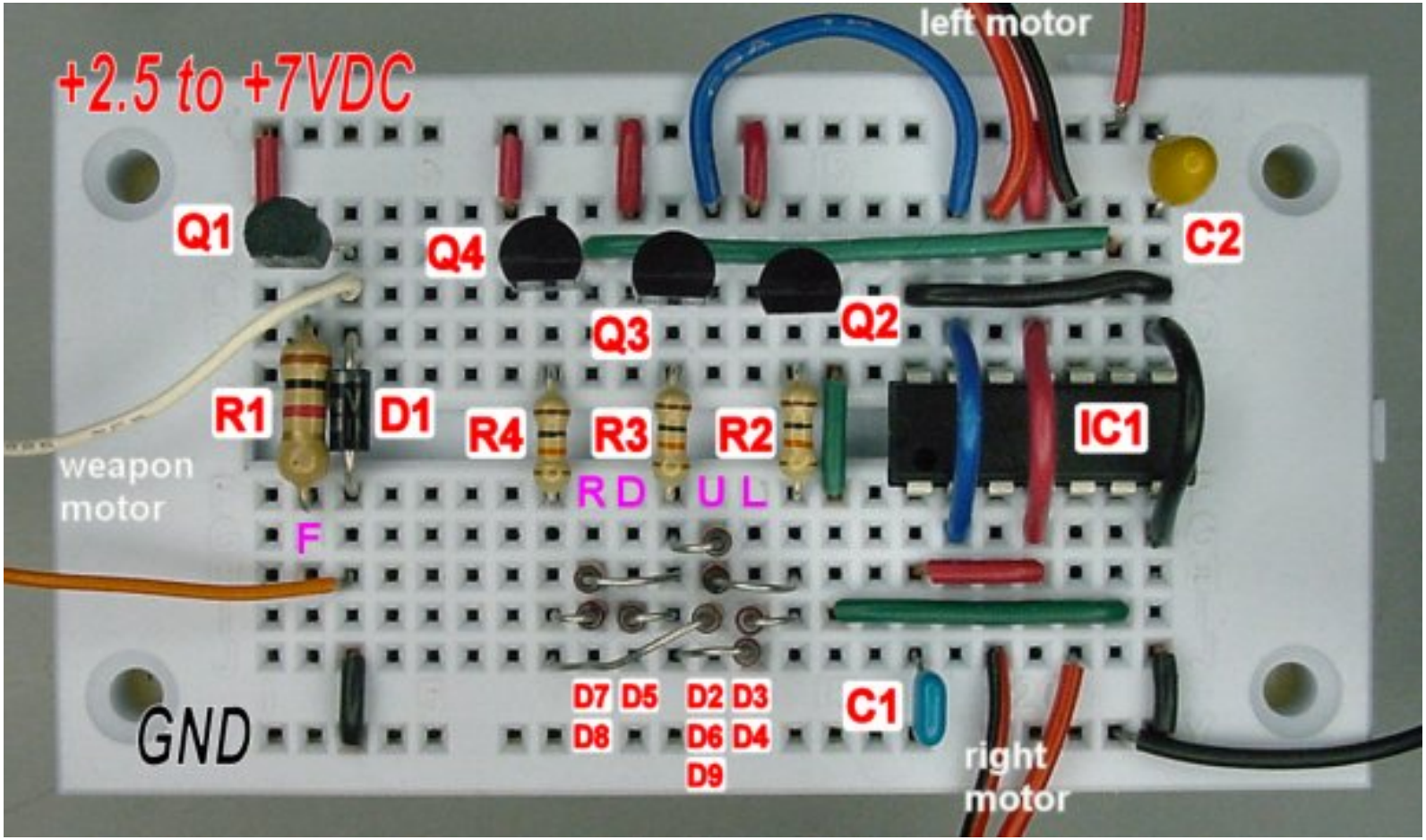
<Change the Physical World>

Motor	Servo
Speaker	LED

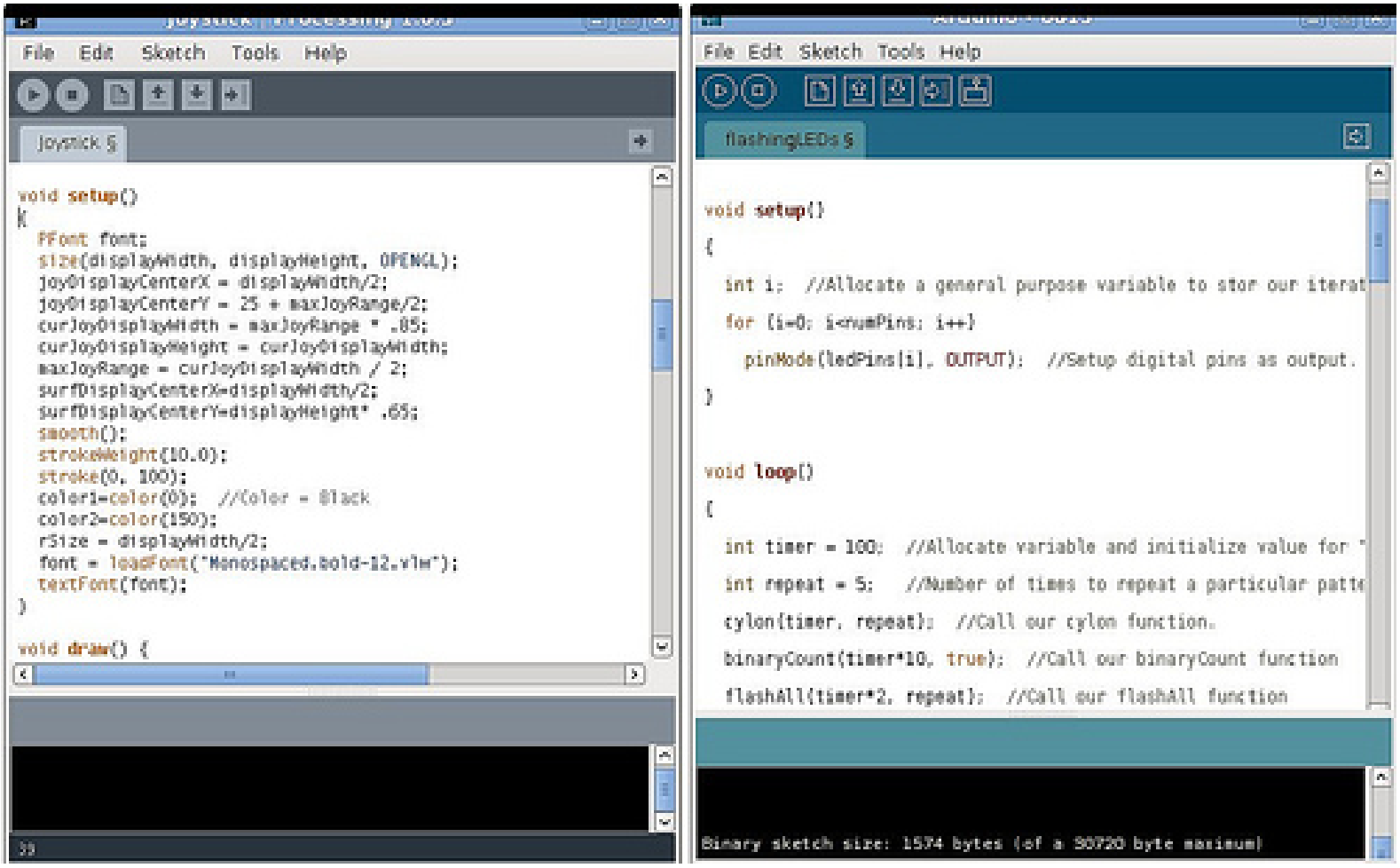
Wires



What
we
are
Going to create….


+2.5 to +7VDC
left motor
Q1
Q4
Q3
Q2
C2
R1
D1
R4
R3
R2
IC1
weapon
motor
R D U L
F
D7 D5 D2 D3
D8 D6 D4
D9
C1
GND
right
motor

Circuits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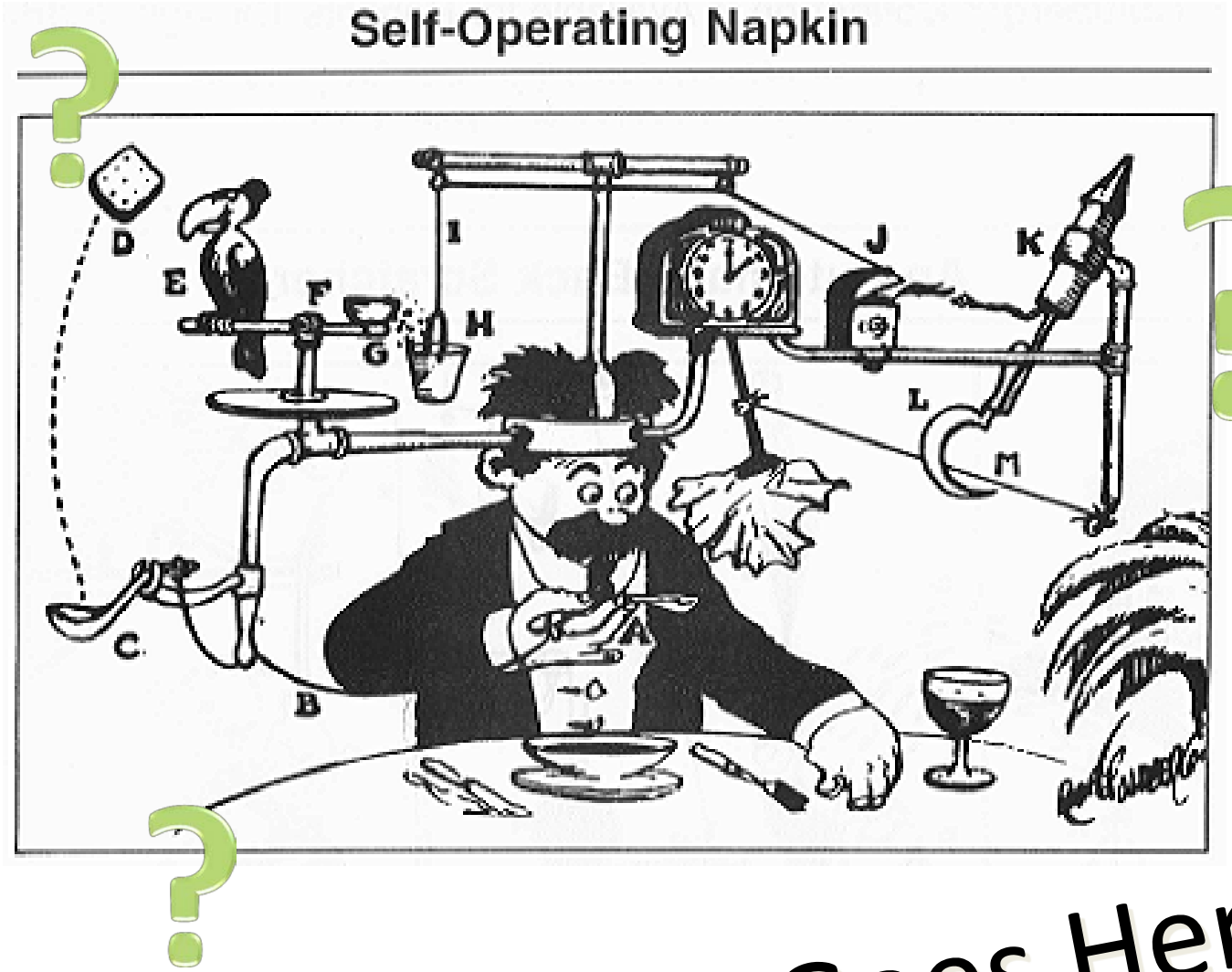
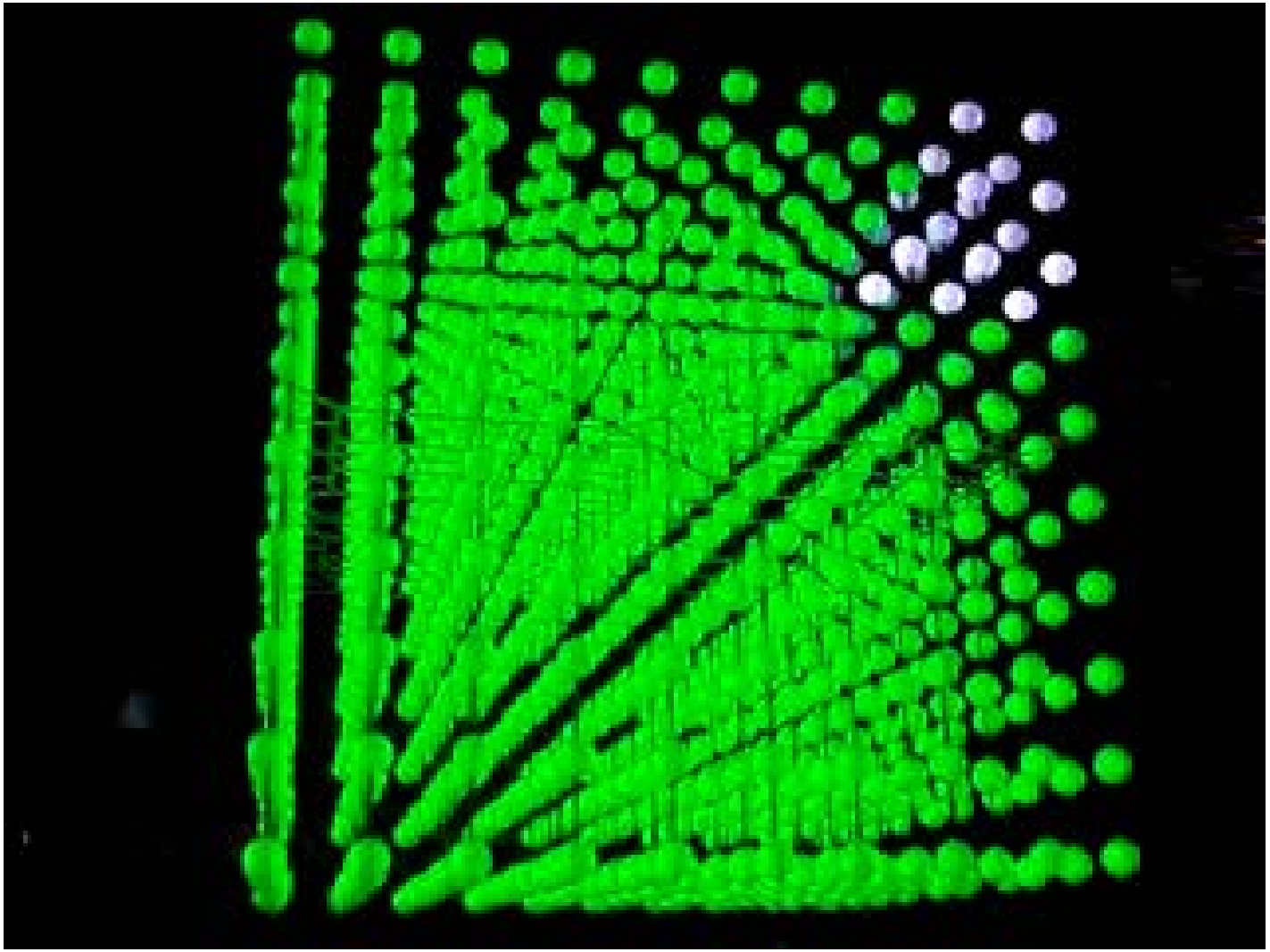


Your Project Goes Here

Breathalyzer Microphone

Speech Synthesizer



3D Led Cube

Botanicall

Laser Harp

Confusion

Bug /b^g/: ***n.*** [Origin uncertain]

When software or circuits don't work as expected.

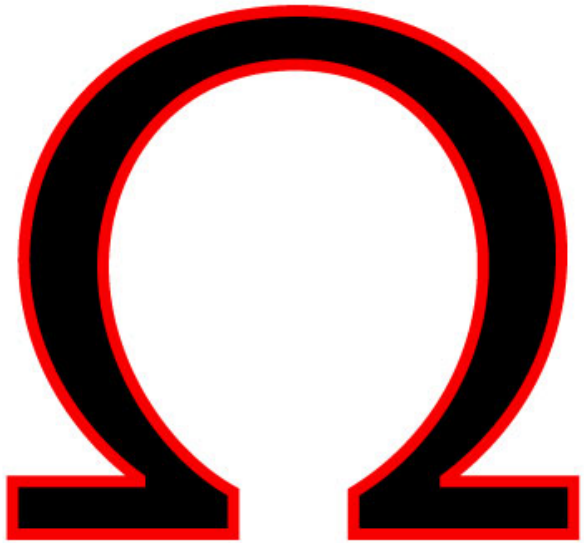
SMOKE ALARM

ARDUINO
UNO

119
119

class Token{
char
char

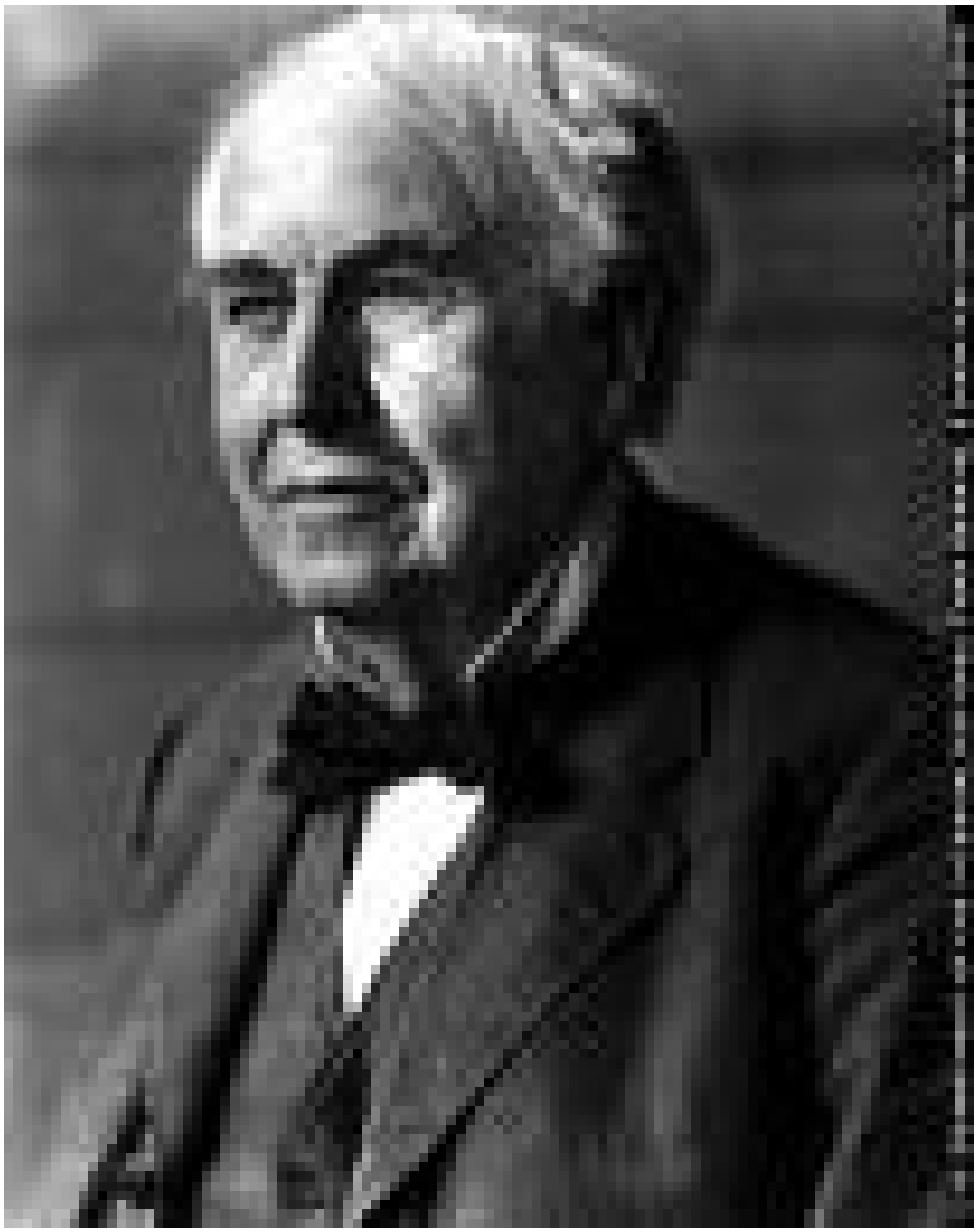
NO SMOKING



“If you’re not failing every now and again,

it’s a sign you’re not doing anything very innovative.”

- Woody Allen



“I haven’t failed;

I’ve found 10,000 ways

that don’t work!”

Creating Basic Circuits:

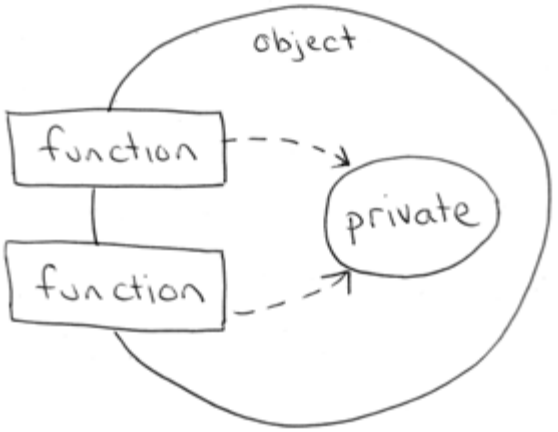
- Basic electronic components
- Basic circuit theory
  - your new favorite equations based on "Ohm's Law"!
- Sensors and actuators in your Kit
- Fundamentals of C-language programming
- The Arduino programming library
- When things don't go as planned….

Also, if you're up for it…

(you know you are!)

Advanced programming techniques

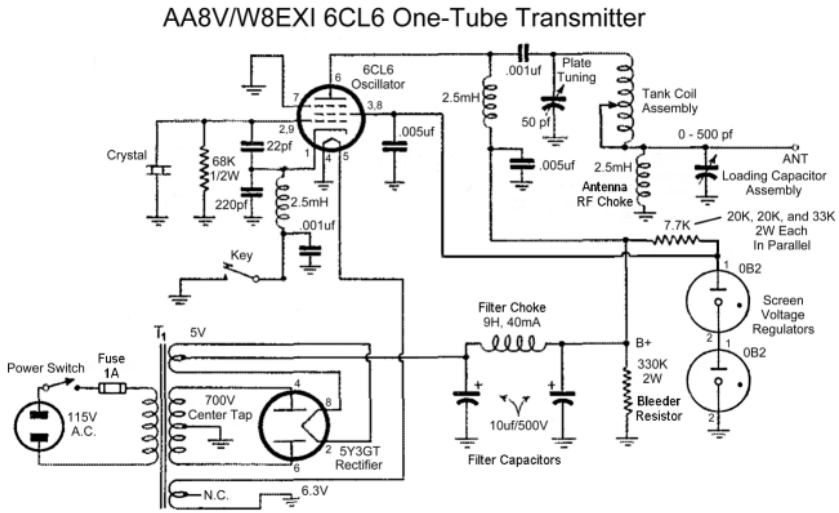
- C++ and object-oriented programming

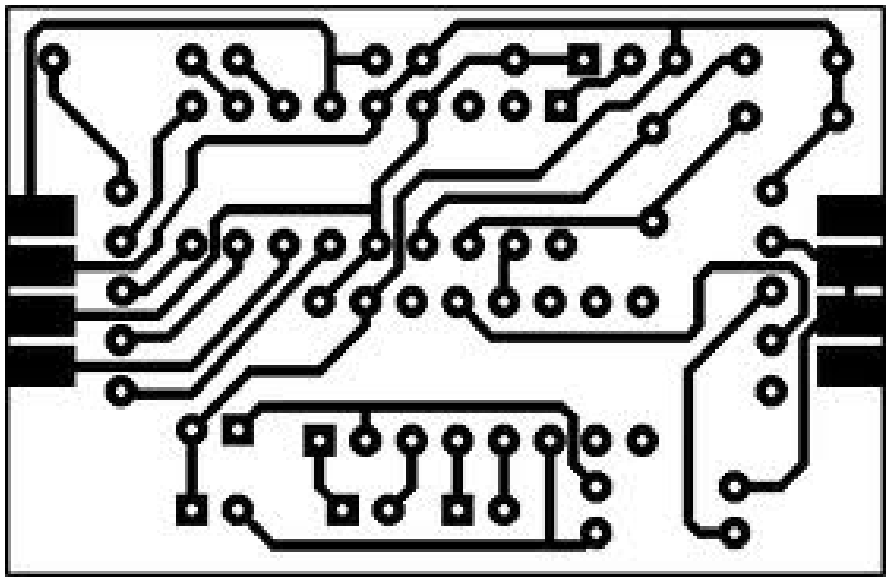


- *Spaghetti-avoidance*

Additional sensor types available to you

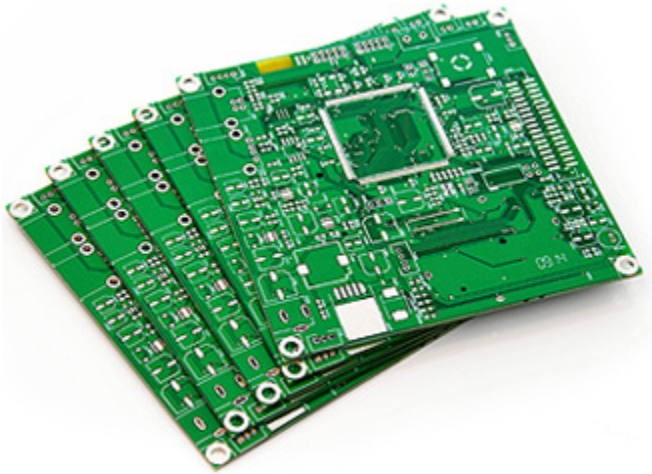
Circuit Design





Board Layout

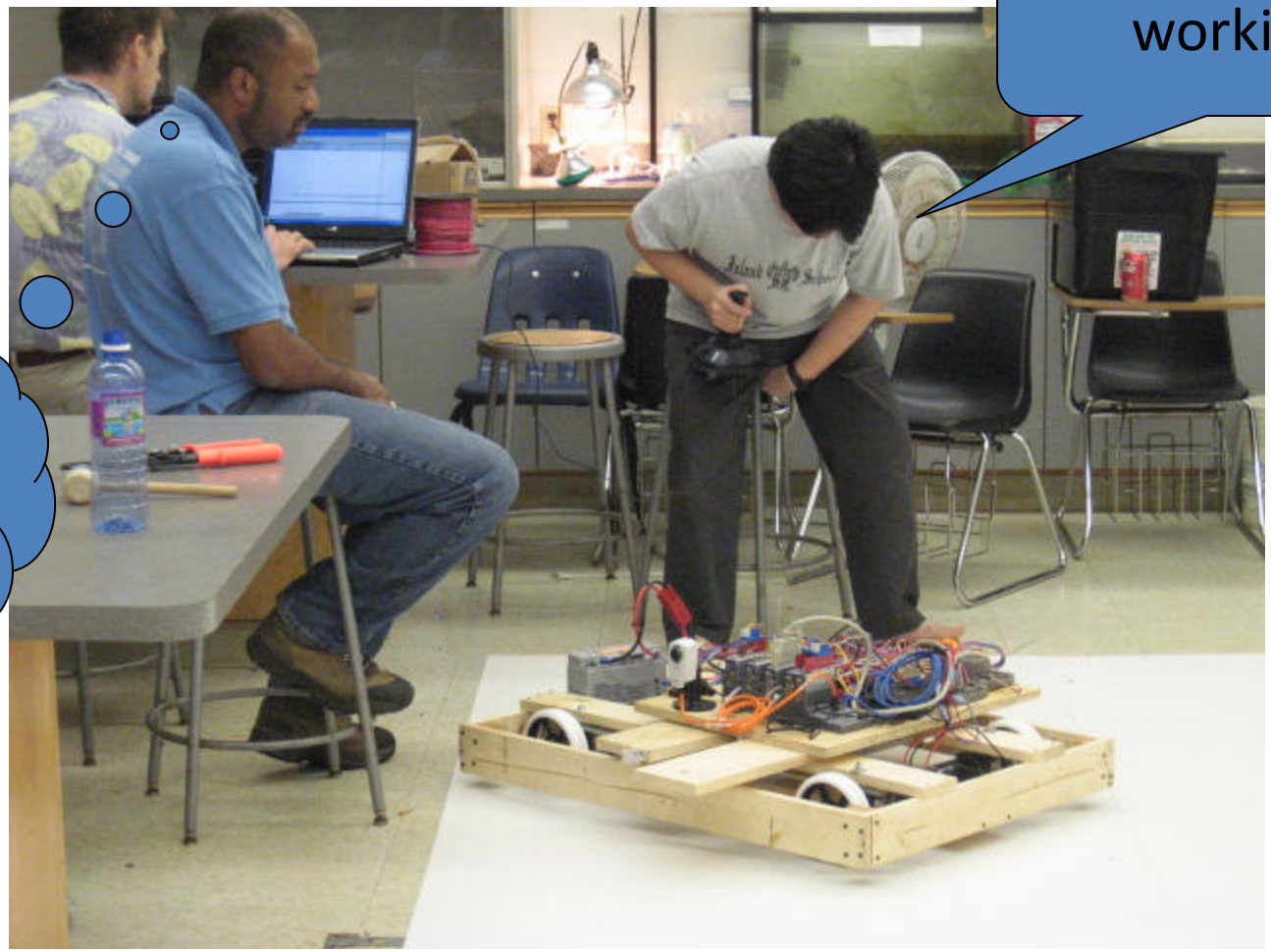
Board Fabrication



Board Assembly

3D-printing

Lab


Why isn't this working?
Did you plug it in?

- Extended time working on your project
- Trying out alternatives
- Debugging

EVERLAST

“Genius is 1% Inspiration

and

99% Perspiration”

- Thomas Edison

SURTREX
PHILIPPIANS
4 : 13
INZER

READY...
SET...
GO