

# **Introduction to Designing Interaction with Electronics workshop**

**Michihito Mizutani**

**[www.michihito.com](http://www.michihito.com)**

# Schedule

## Monday

09:15 - 11:00

- Introduction

11:00 - 12:00

- Group discussions

13:00 - 16:00

- Assembling electronics

## Tuesday

Programming microcontrollers

09:15 - 10:00

- Basics

10:00 - 11:00

- Architecture

11:00 - 12:00

- Controls

13:00 - 16:00

- I/O commands

## Wednesday

09:15 - 12:00

- Serial communication

13:00 - 14:00

- Connecting microcontroller to PC

14:00 - 16:00

- Group work

## Thursday

09:15 - 16:00

- Group work

## Friday

09:15 - 13:00

- Group work

13:00 - 15:00

- **Presentations**

15:00 - 16:00

- Clearing away tools

## The goal of this workshop

This workshop gives you tools to prototype interactive systems. It is **NOT** aiming to **UNDERSTAND** technical tools **BUT USE** them in research projects and design practices of your own.

It requires your **CREATIVE MINDS** otherwise you cannot use them.

## My role in this workshop

I am an professional **INTERACTION DESIGNER**, not engineer. So I will not be able to teach you technical knowledge in detail.

The workshop focuses on introducing the tools and giving instructions how to make **RAPID PROTOTYPES**.

## Your participations in this workshop

You don't need to prototype everything from scratch. By sharing knowledge and experiences, we can prototype things even more rapidly.

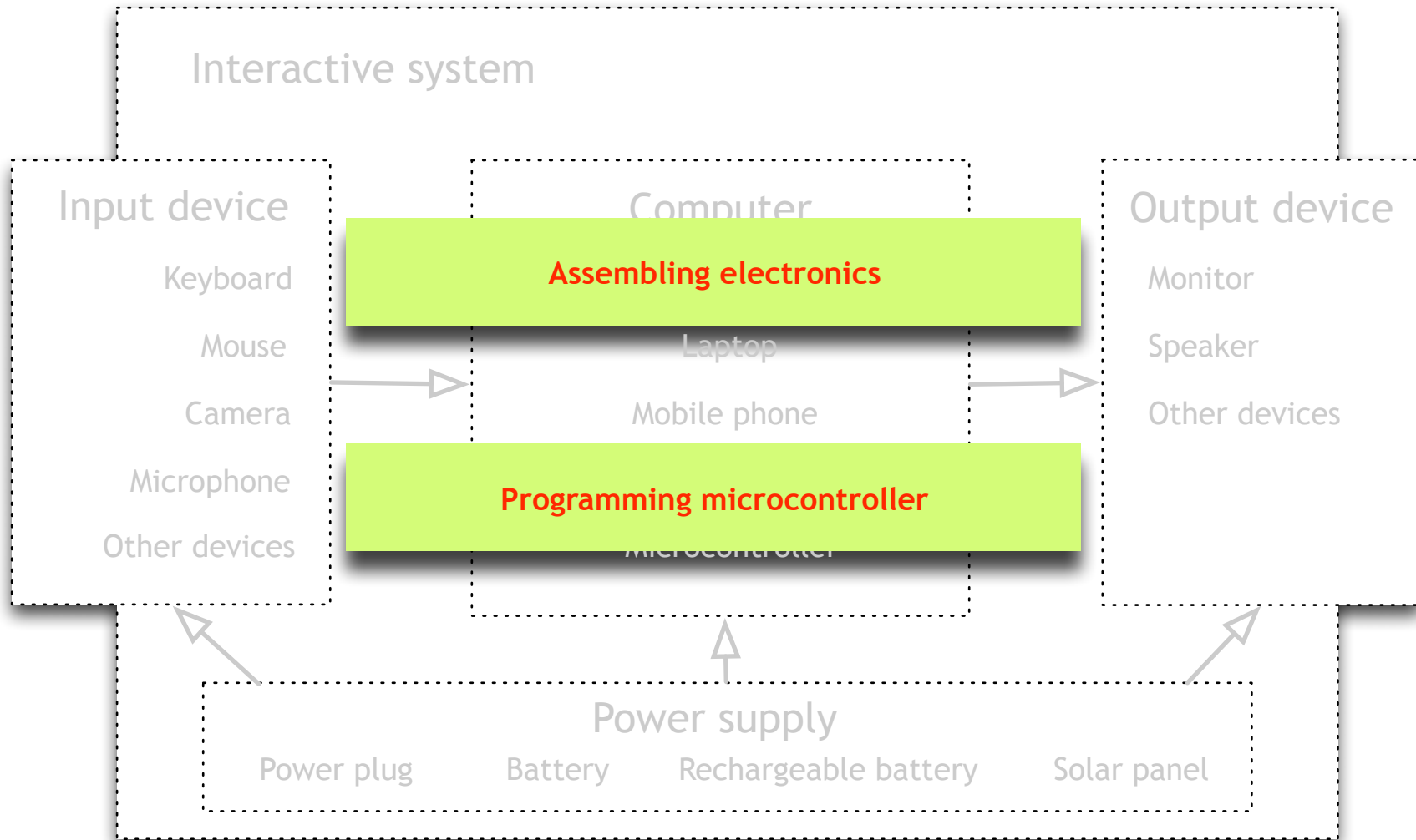
You can **SEARCH SNIPPETS** online. But you need to **SHARE YOUR CODES AND SCHEMATICS** online with other people as well.

**What can we do after this workshop?**

**[http://www.youtube.com/view\\_play\\_list?p=49FF1331AB8AA149](http://www.youtube.com/view_play_list?p=49FF1331AB8AA149)**

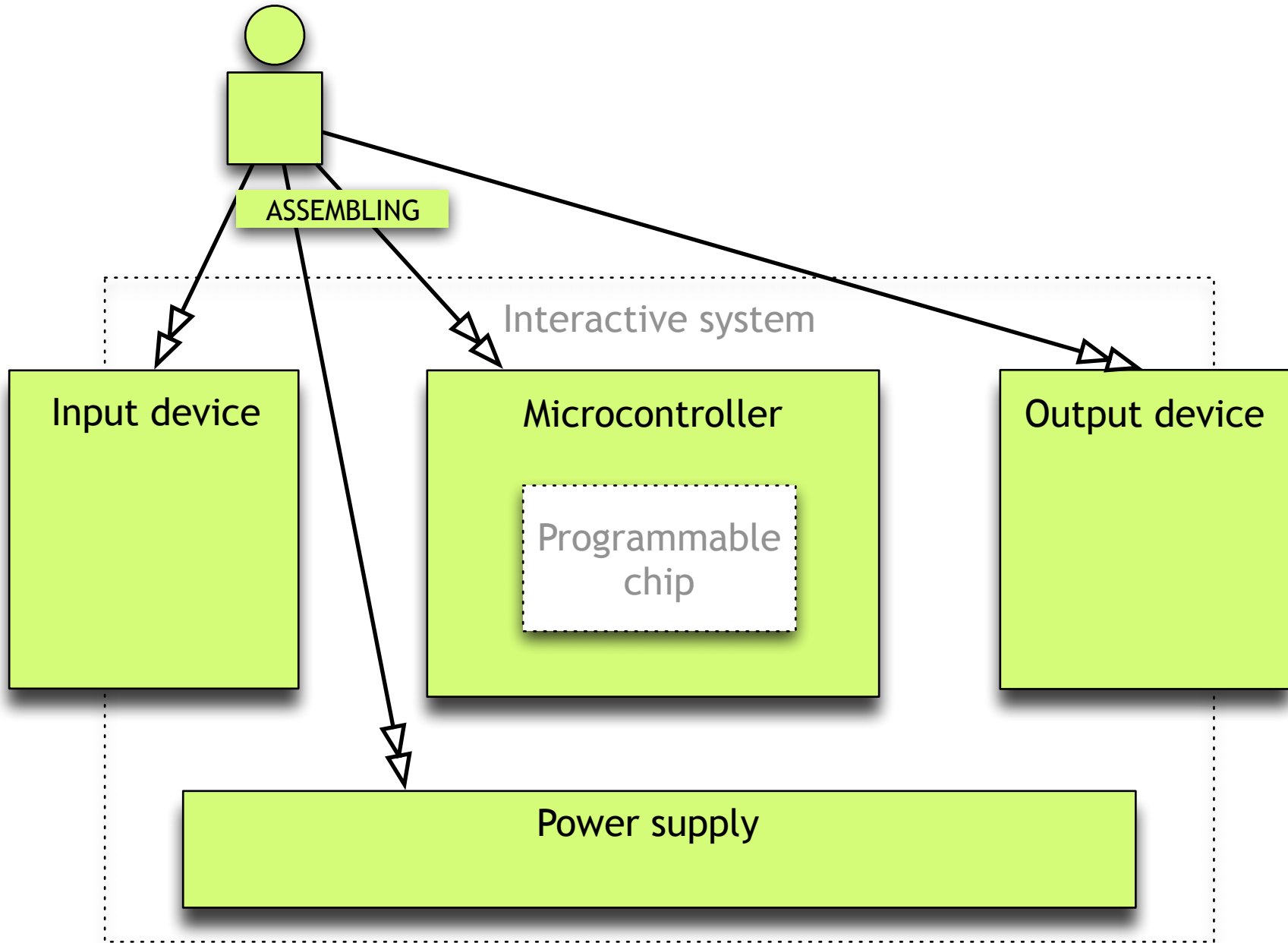
**What are we going to do in this workshop?**

# What are we going to do in this workshop?

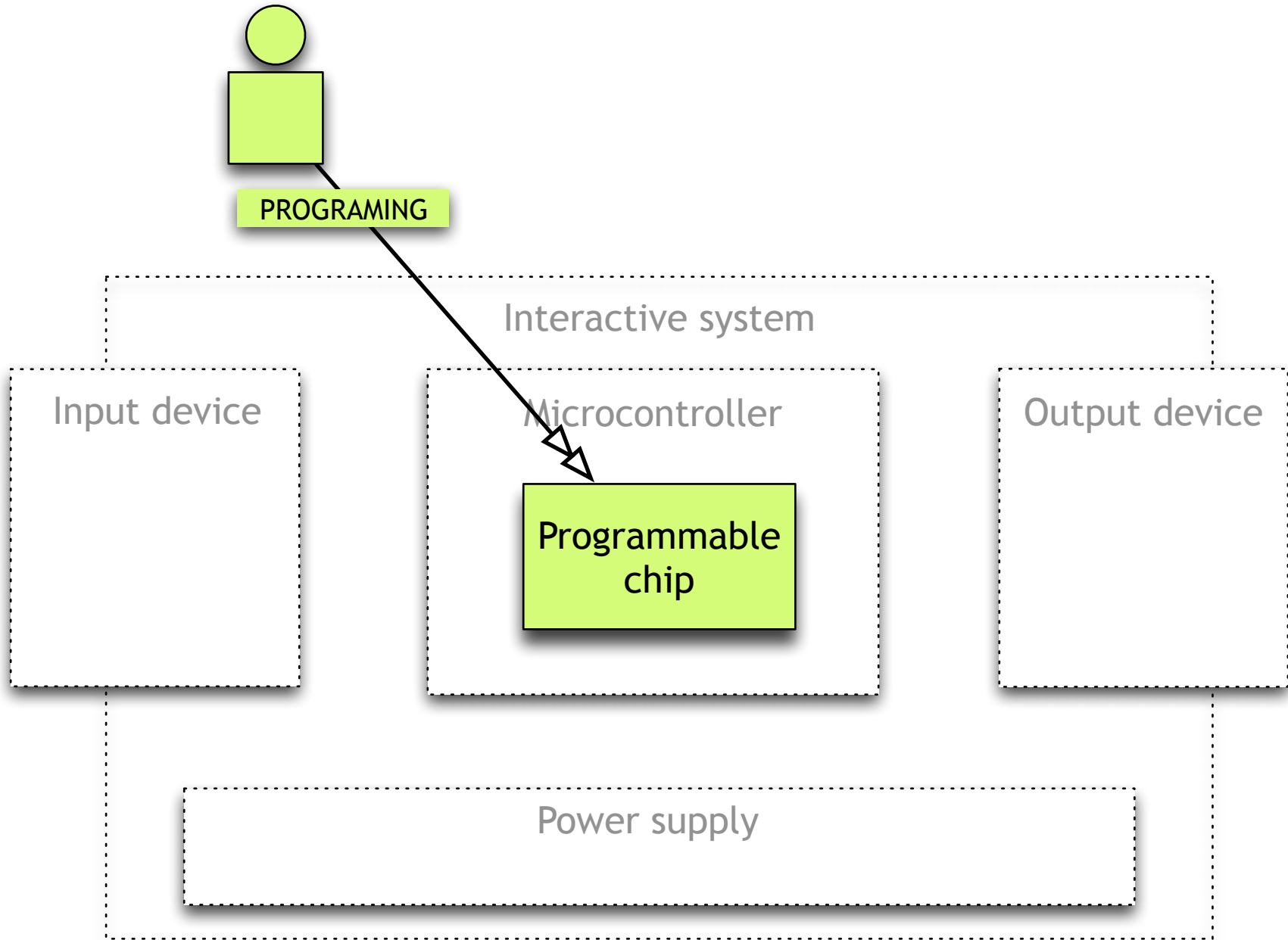




# Assembling Electronics



# Programming Microcontroller





## **Assignment**

**Create a rapid prototype with your group following a given theme.**

## Theme

Prototype an interactive system  
that enables **user to**  
**communicate with others.**

## Credits from this workshop

Students are expected to **share experiences** (description, code, photos and videos) in the following blog to explain how you developed your work.



**Paja Blog**

**<http://mlab.taik.fi/paja/>**



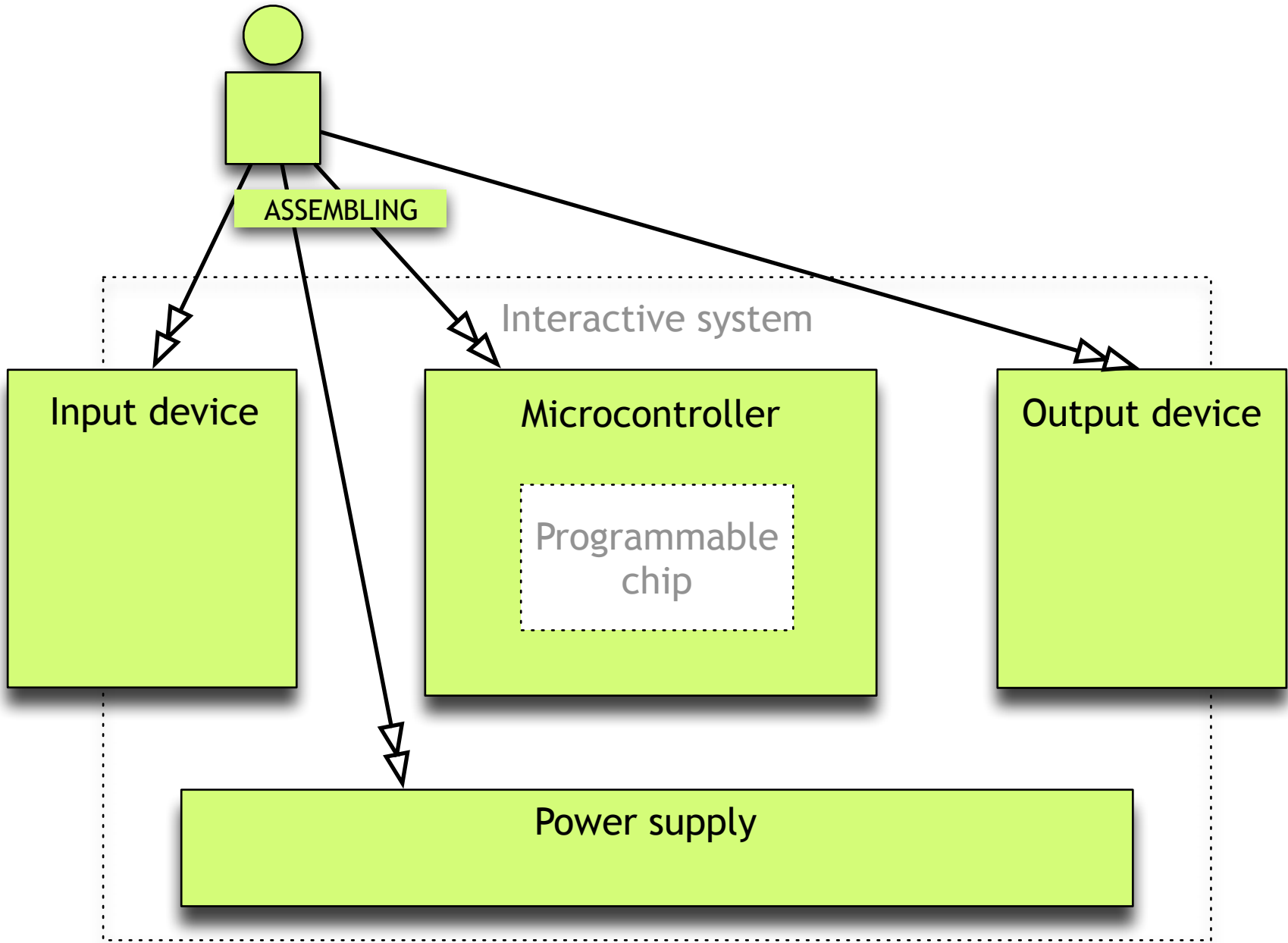
Create an account in the blog

Please do not forget to **fill your full name in your profile** otherwise I won't know who you are when you make a post.

<http://mlab.taik.fi/paja/>



**Assembling electronics**



**Basic tools**

# Board of Education Development Board

Plug a 9V adapter here.

Plug USB B-mini or RS232 here.

Breadboard access for power

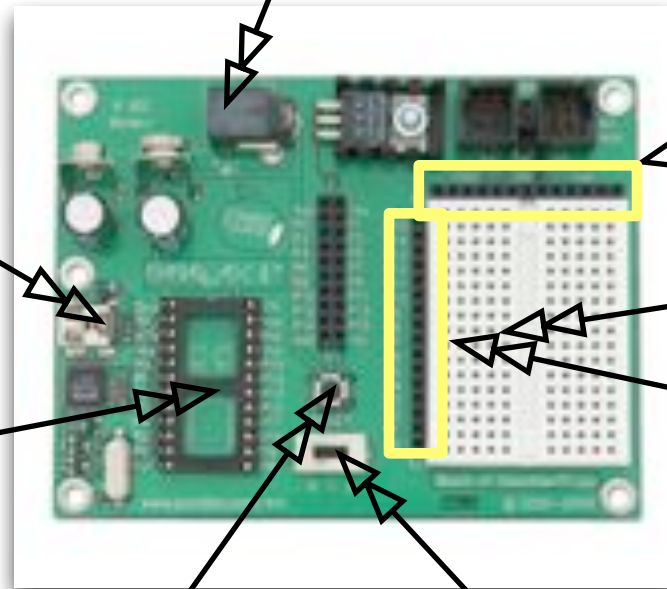
Install the BASIC Stamp 2 here.

Breadboard

Breadboard access for BS2 pins

Reset button

Power Switch



## BASIC Stamp 2 (Microcontroller)



BASIC Stamp 2  
microcontroller

## 9V adapter and cables to connect BS2 to your computer



9V AC adapter



USB A-B mini cable or  
RS232 and USB A-B cable with Serial adapter



# Breadboard

+

-

Vdd

GND

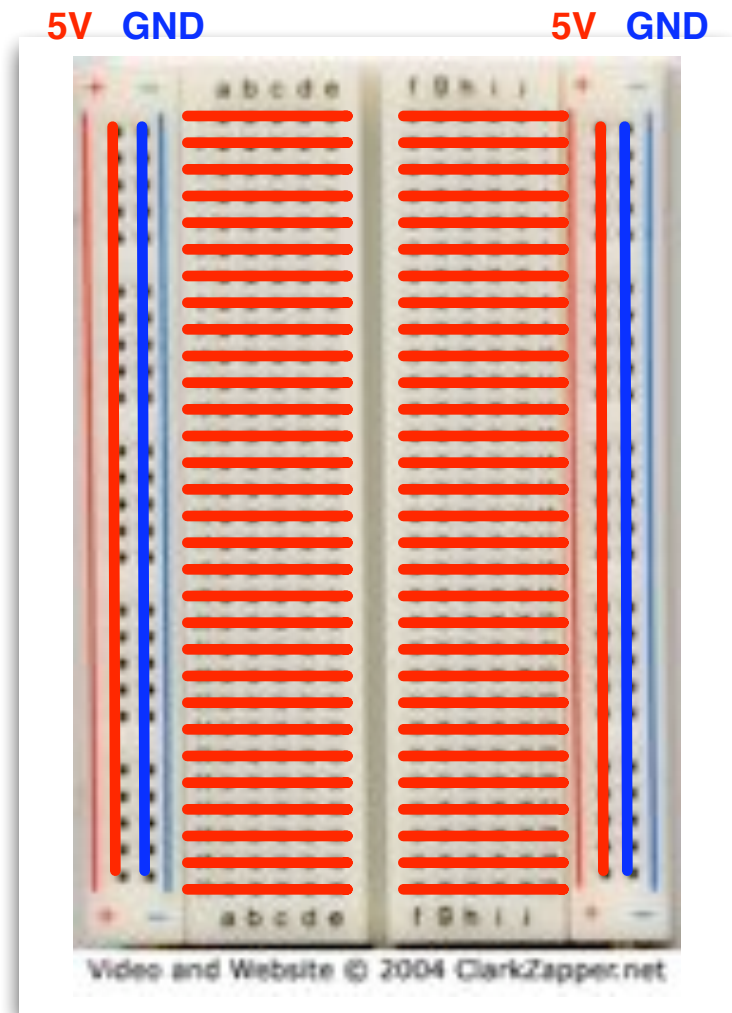
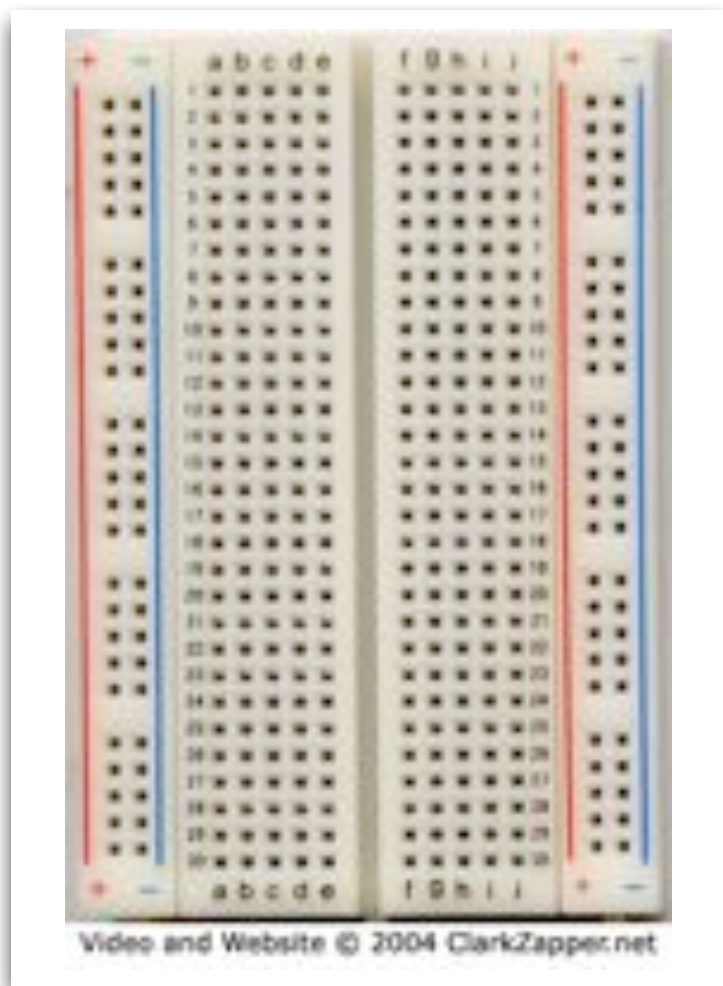
5V

Vss



Breadboard (photo)

Breadboard (schematic)



Video and Website © 2004 ClarkZapper.net

Video and Website © 2004 ClarkZapper.net

## Jumper wires



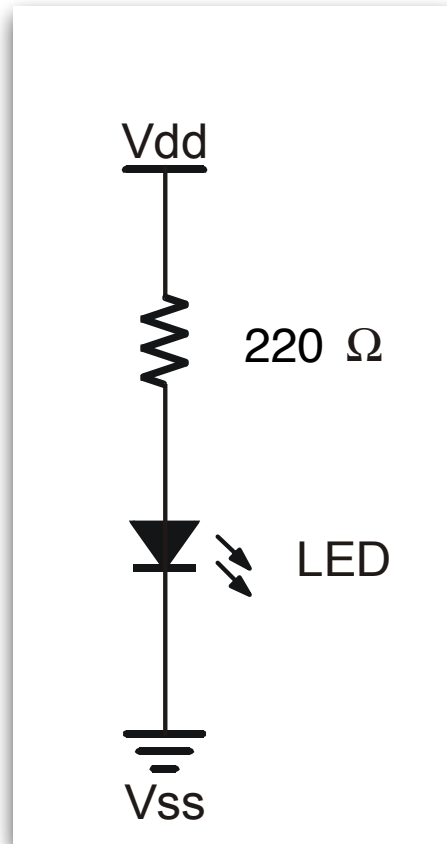
# Multimeter



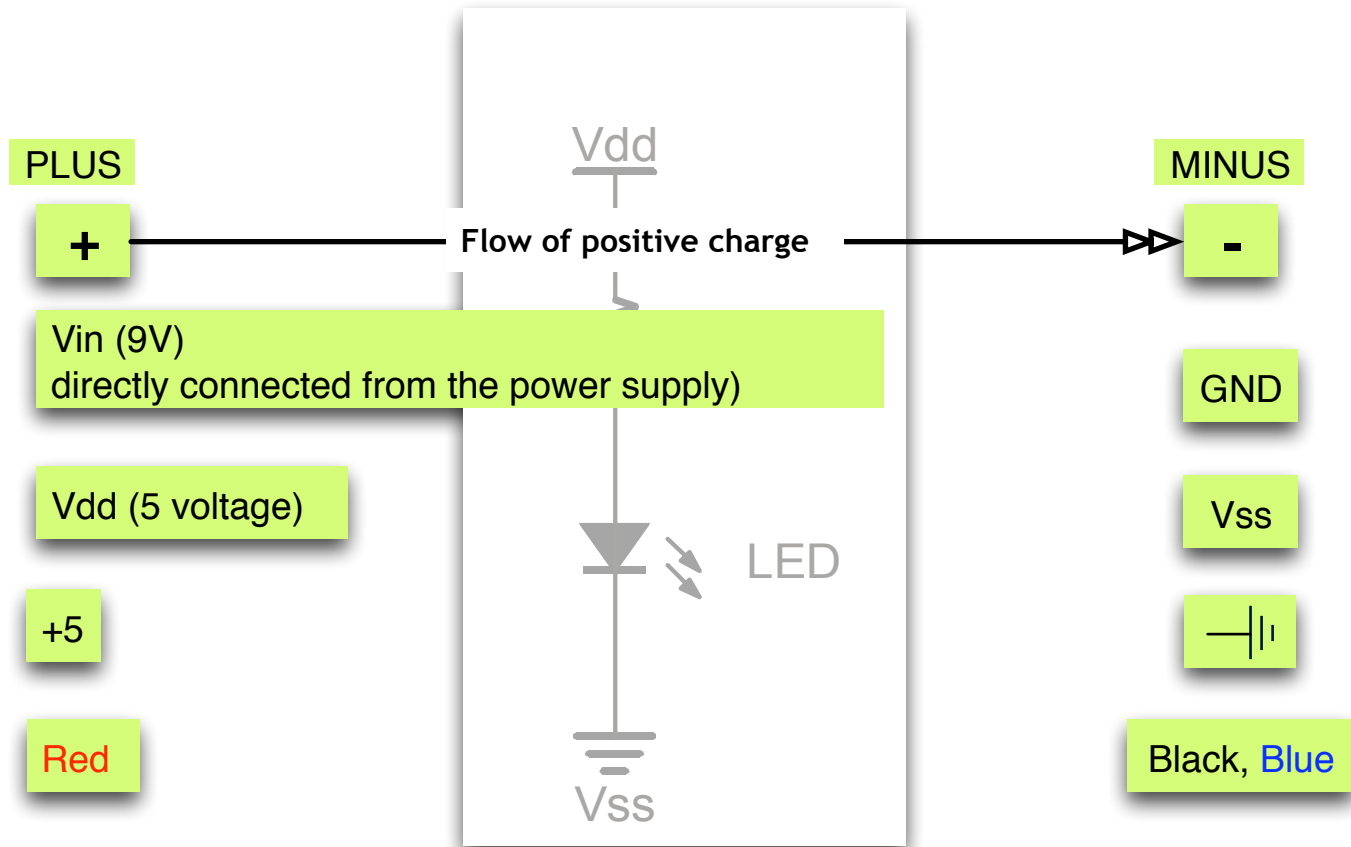


## Understanding schematics

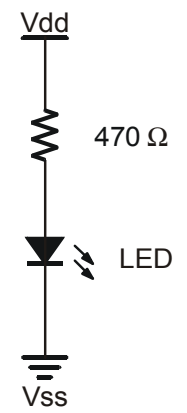
What is this mean?



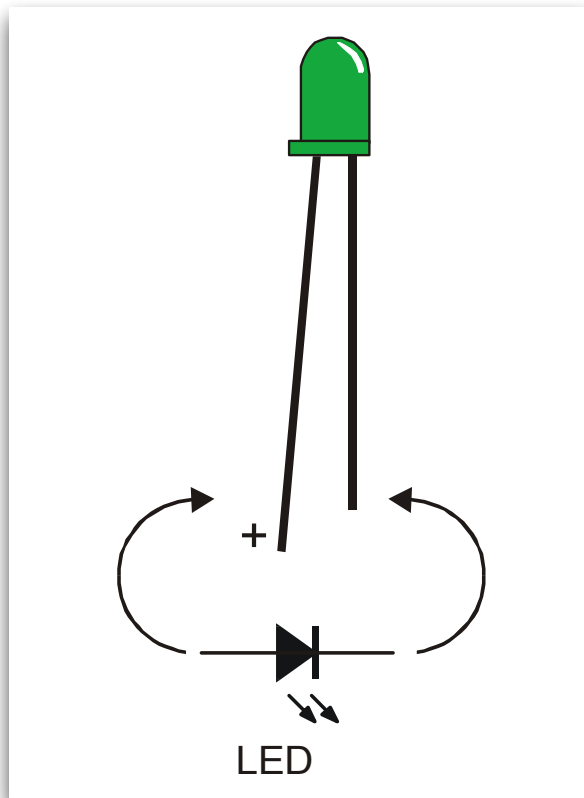
# Flow of positive charge



# Popular components

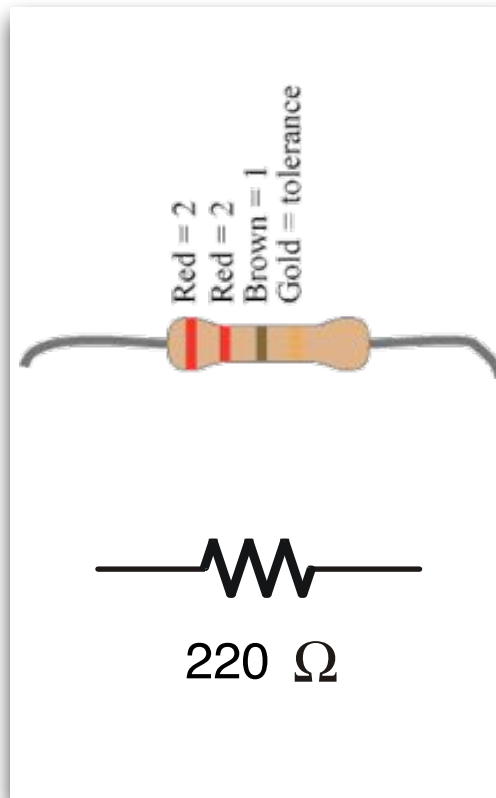


## LED (Light emitting diode)



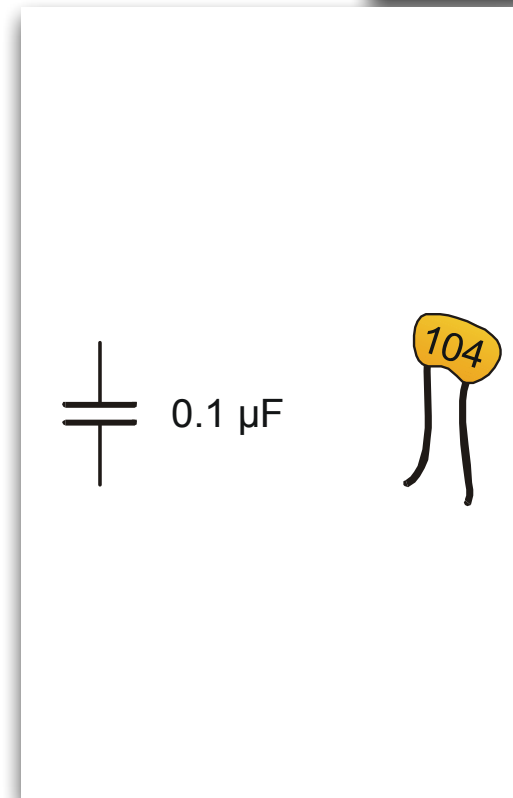
a semiconductor device with two terminals, typically allowing the flow of current in one direction only. LED has polarity

## Resistor



a device having a designed resistance to the passage of an electric current.

## Capacitor

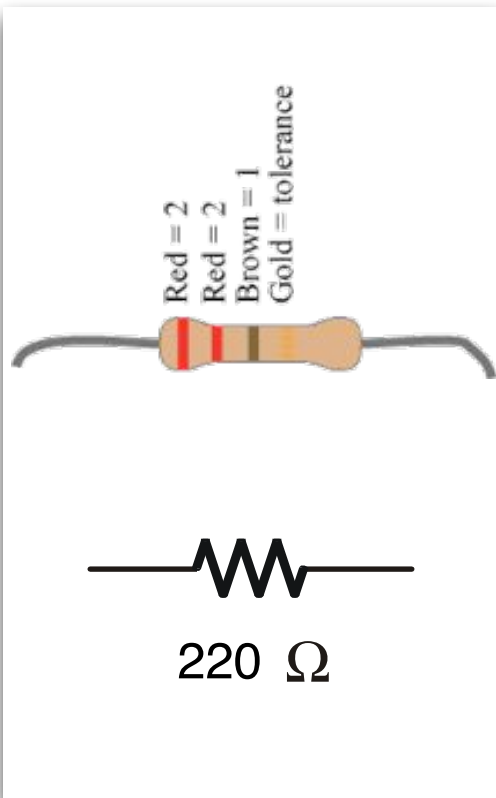


a device used to store an electric charge



# Markings for resistors

## Resistor



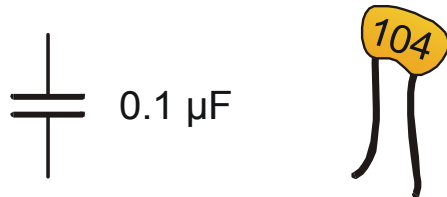
a device having a designed resistance to the passage of an electric current.

Color	Number	Multiplier	Tolerance
Black	0	1	-
Brown	1	10	±1%
Red	2	10 <sup>2</sup>	±2%
Orange	3	10 <sup>3</sup>	±0.05%
Yellow	4	10 <sup>4</sup>	-
Green	5	10 <sup>5</sup>	±0.5%
Blue	6	10 <sup>6</sup>	±0.25%
Purple	7	10 <sup>7</sup>	±0.1%
Gray	8	10 <sup>8</sup>	-
White	9	10 <sup>9</sup>	-
Shiver	-	10 <sup>-2</sup>	±10%
Gold	-	10 <sup>-1</sup>	±5%
No color	-	-	±20%

Download a widget called "Resistulator" in your Mac

# Markings for capacitors

## Capacitor



a device used to store an electric charge

Capacitor three digit markings

CODE / Marking	$\mu\text{F}$ microfarads	nF nanofarads	pF picofarads
1R0	0.000001	0.001	1
100	0.00001	0.01	10
101	0.0001	0.1	100
102	0.001	1	1,000
103	0.01	10	10,000
104	0.1	100	100,000
105	1	1,000	1,000,000
106	10	10,000	10,000,000
107	100	100,000	100,000,000

# Assemble electronics

+

-

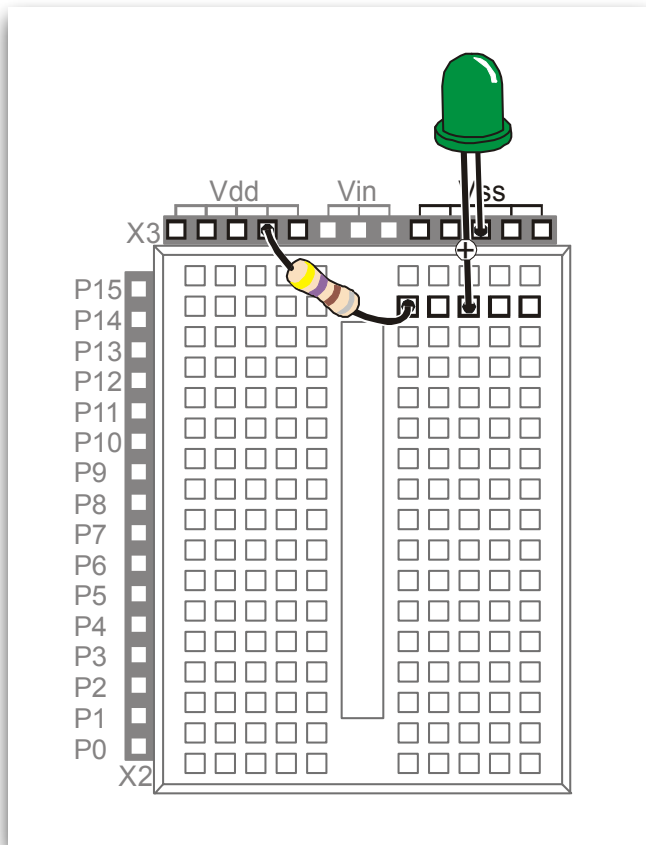
Vdd

GND

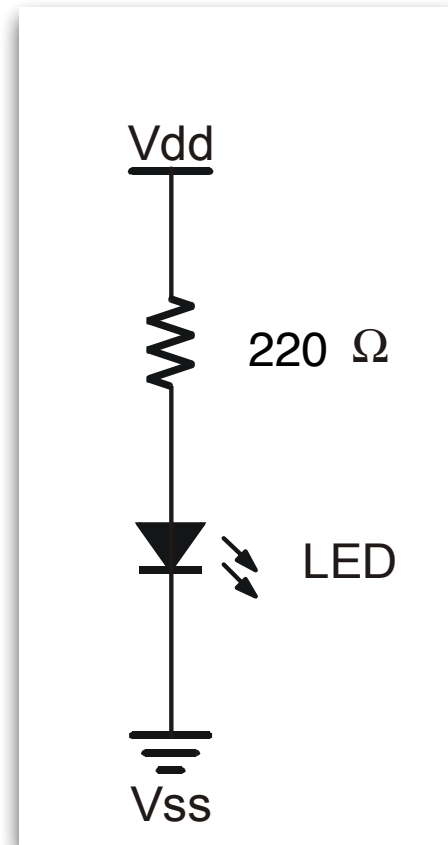
5V

Vss

## Breadboard (photo)

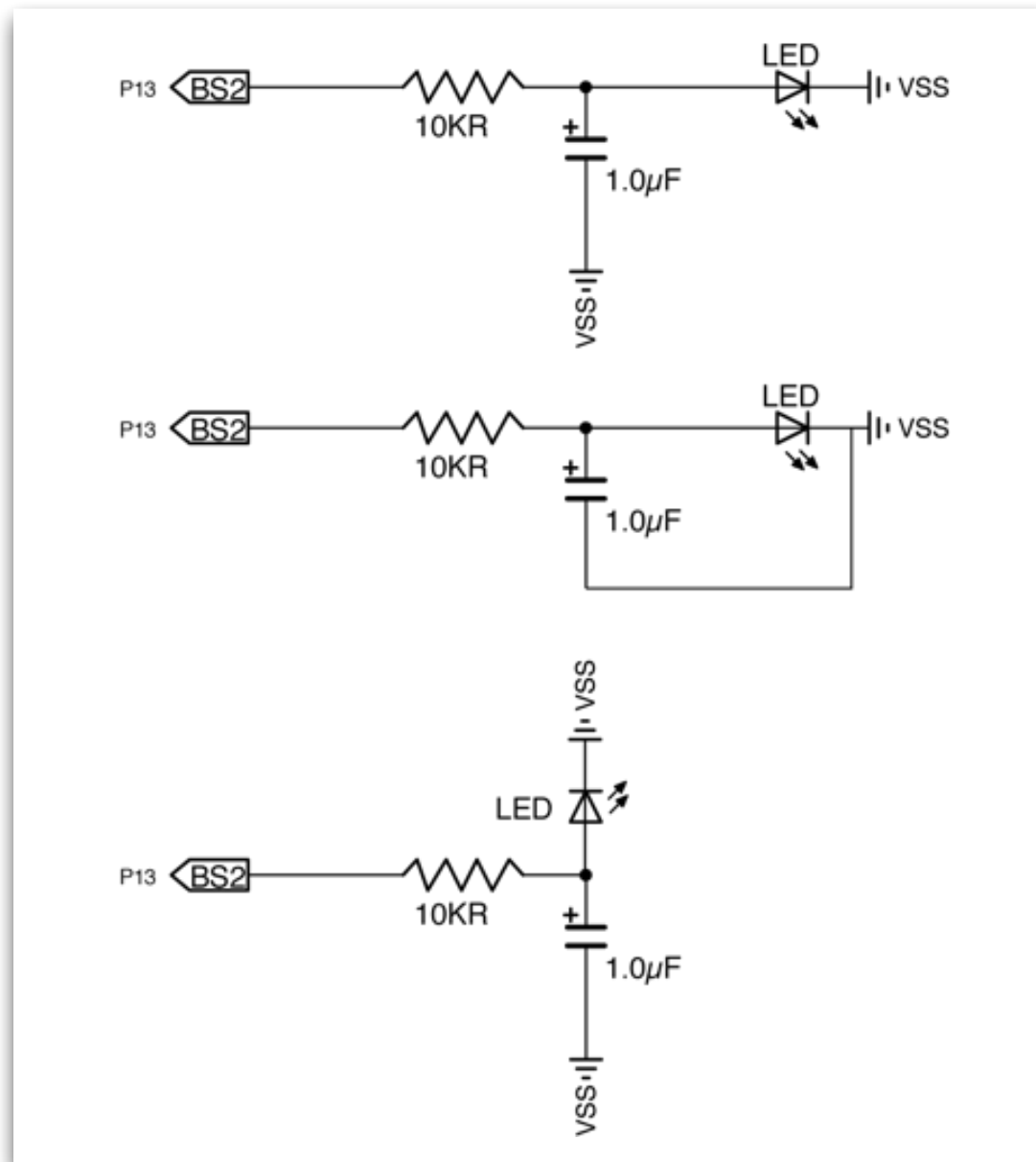


## Breadboard (schematic)



## Schematic plans

These are all same schematics.



**Checking your circuit**

Multimeter



Measuring voltages

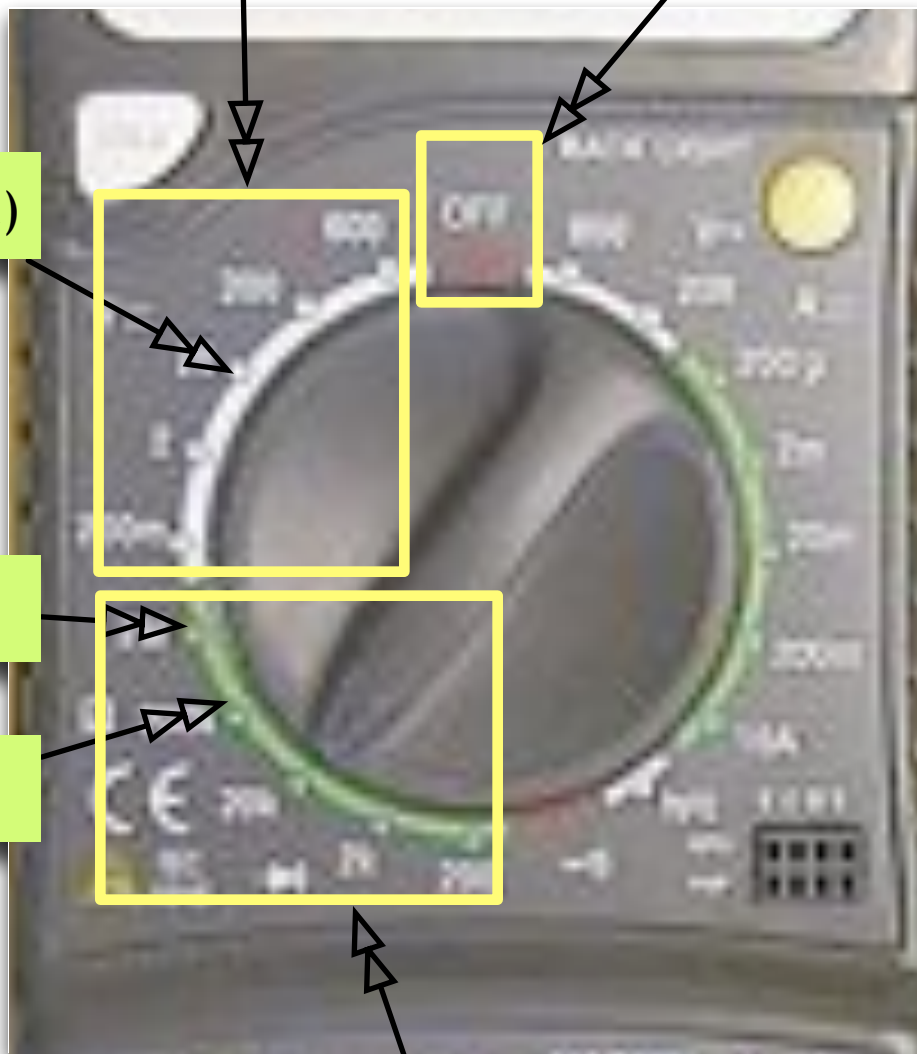
Off switch

20V(DC)

2MΩ

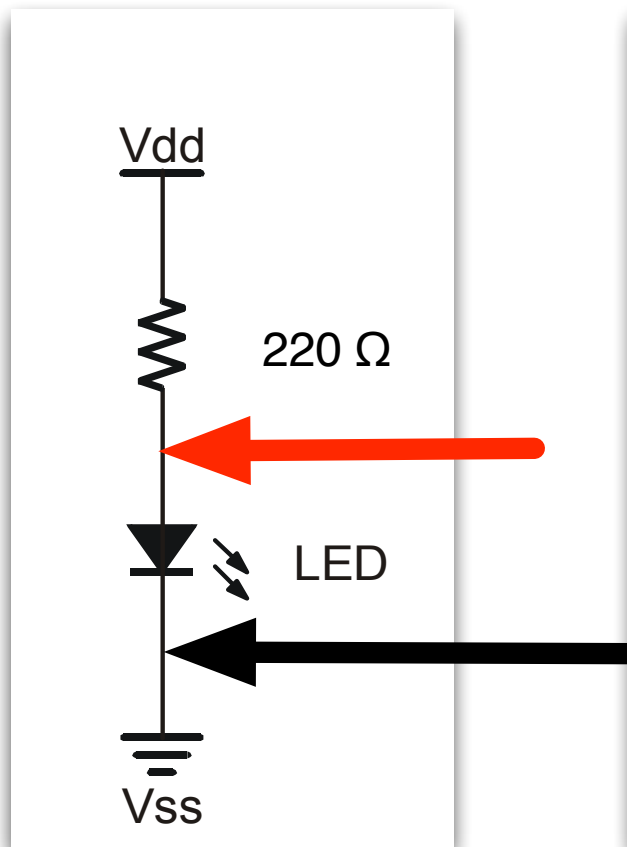
200KΩ

Measuring conductivity and resistance

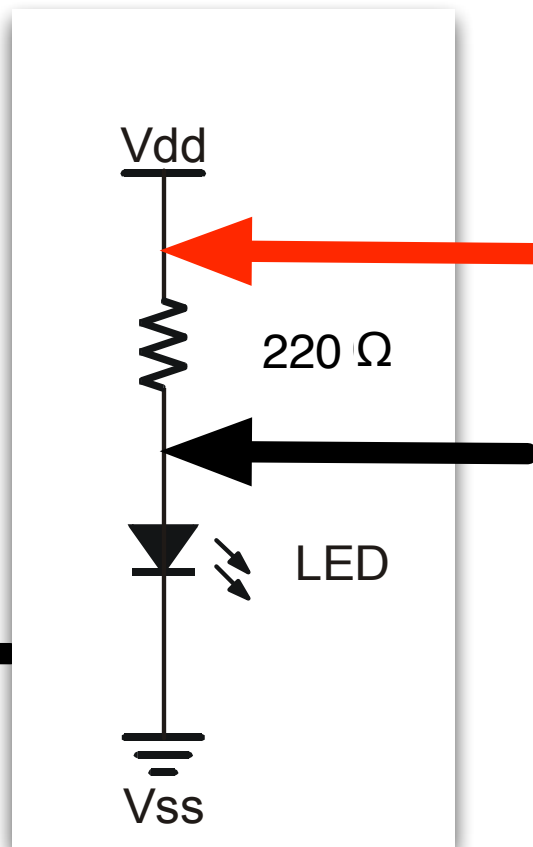


# Measuring electricity with multimeter

## Voltage

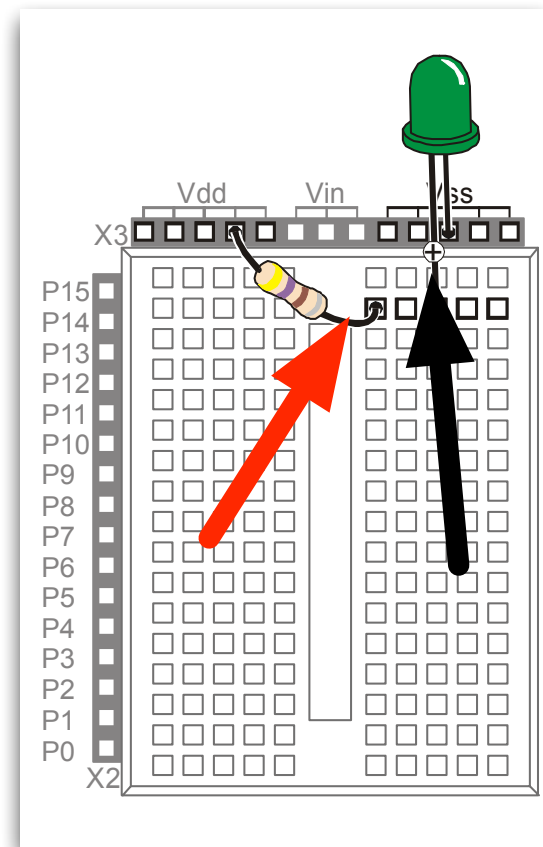


## Resistance



Turn off power.

## Conductivity



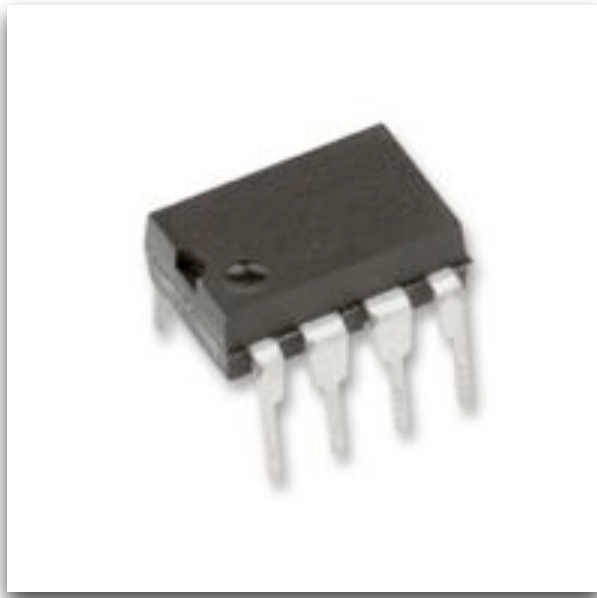
Turn off power.

**Assembling sensor**



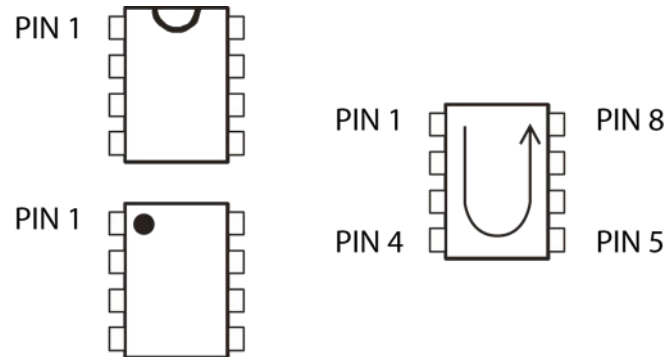
## IC (Integrated Circuit)

It's a magic blackbox!

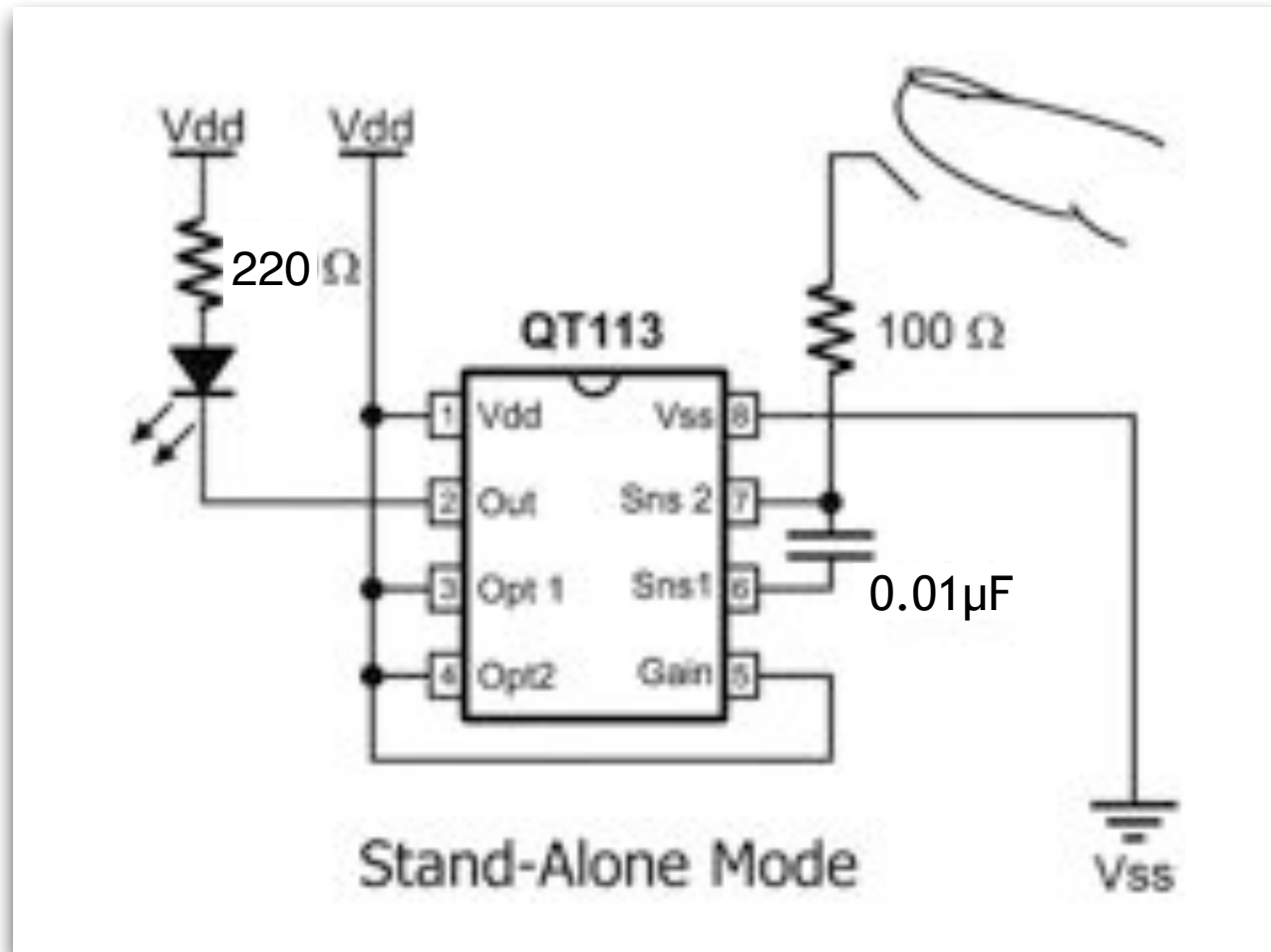


E.g. QT113 touch sensor

## PIN assignment



## IC (Integrated Circuit)



E.g. QT113 touch sensor