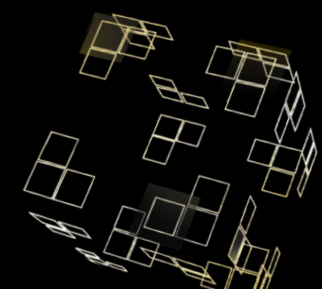
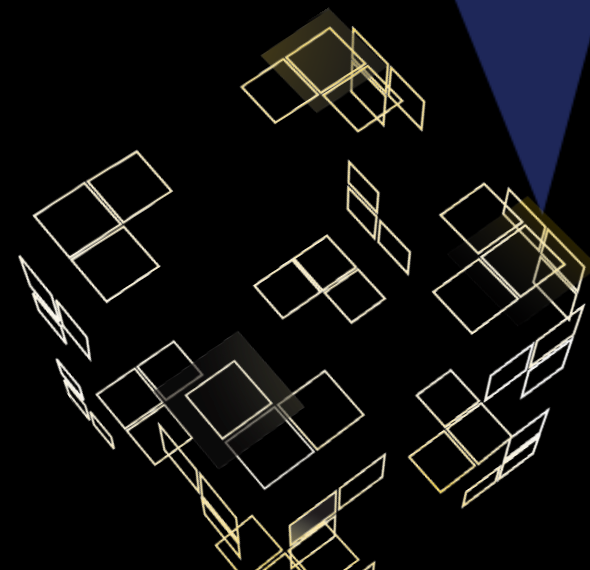


Introduction to Sensors – Practical

Industry 4.0 with Human Touch, Technology course

By Fjodor van Slooten



UNIV
OF T



CONTENT

Introduction to Sensors - Practical

- Introduction to prototyping with Arduino
- Practical (Thursday morning)

Contact: f.vanslooten@utwente.nl

This presentation & tutorials available at:
vanslooten.com/i40 or via Canvas

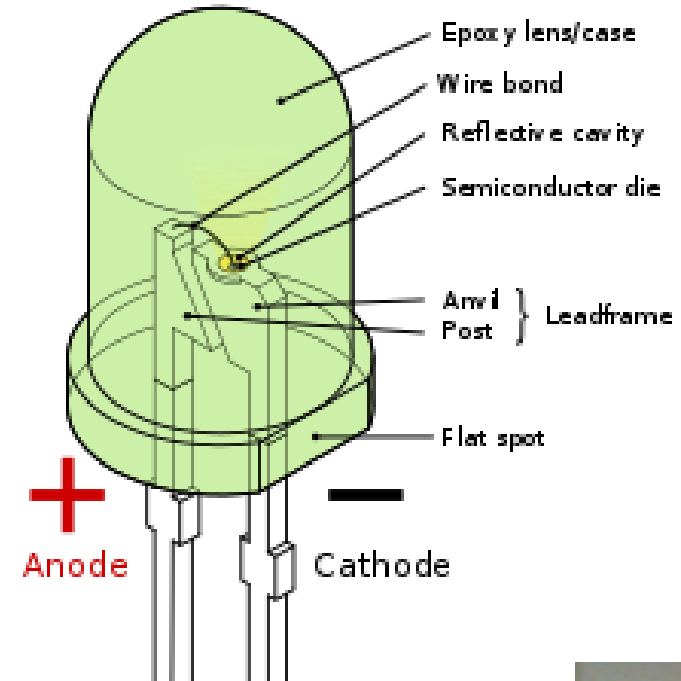
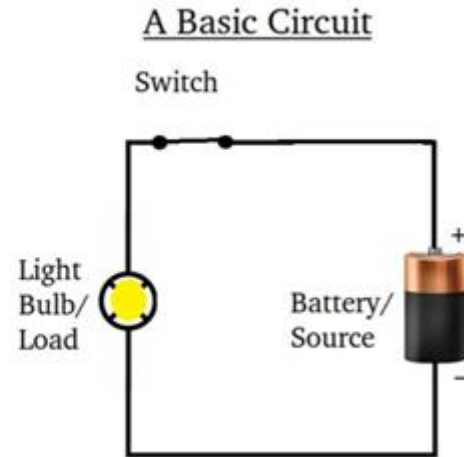
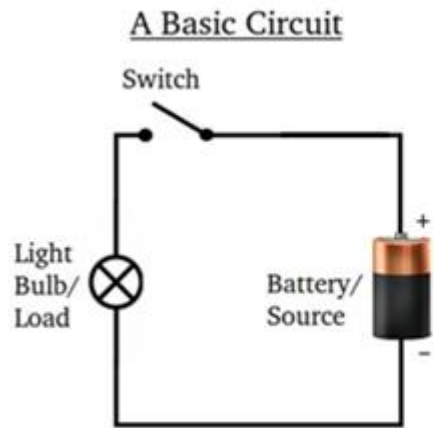
11/30/2020

Introduction to Sensors - Industry 4.0 with Human Touch



Electronics 101

Current flows from + to - when a circuit is complete



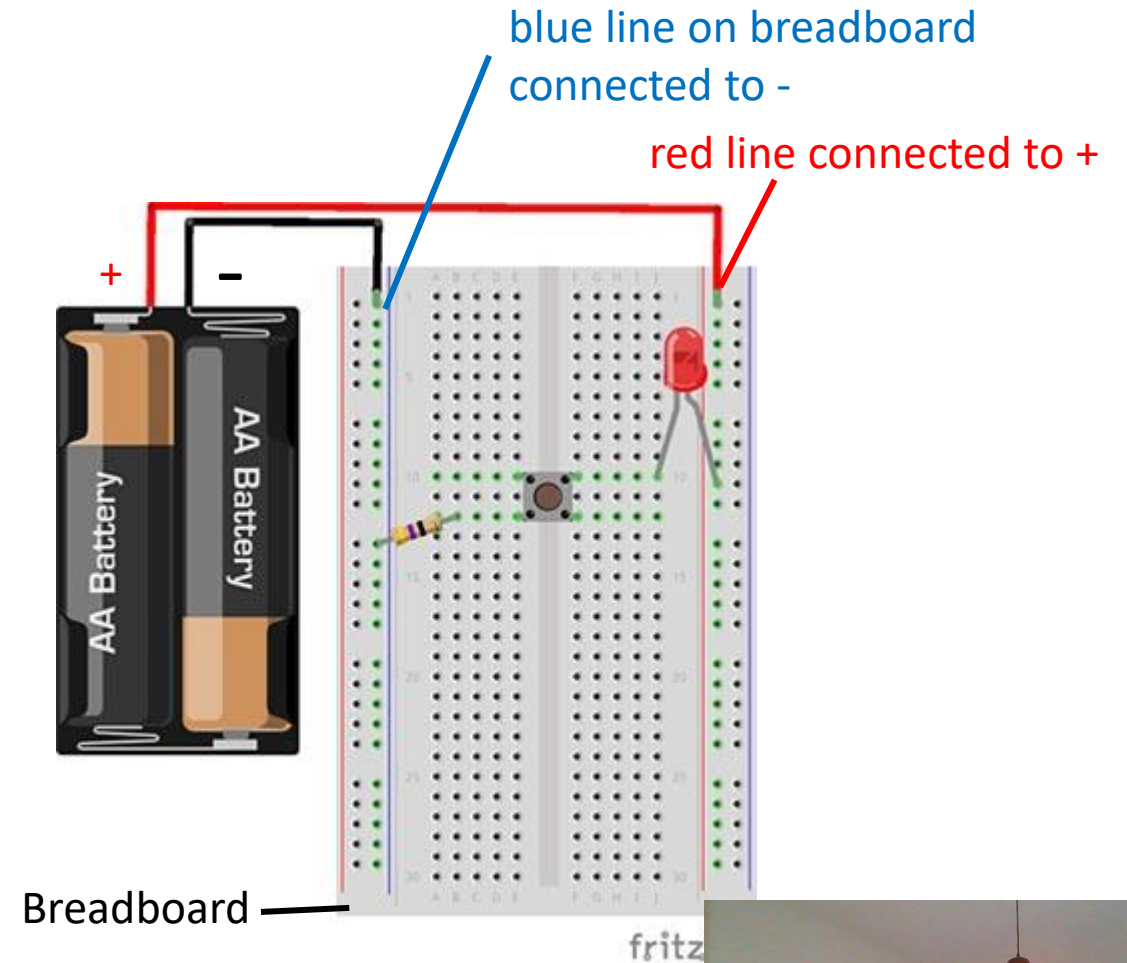
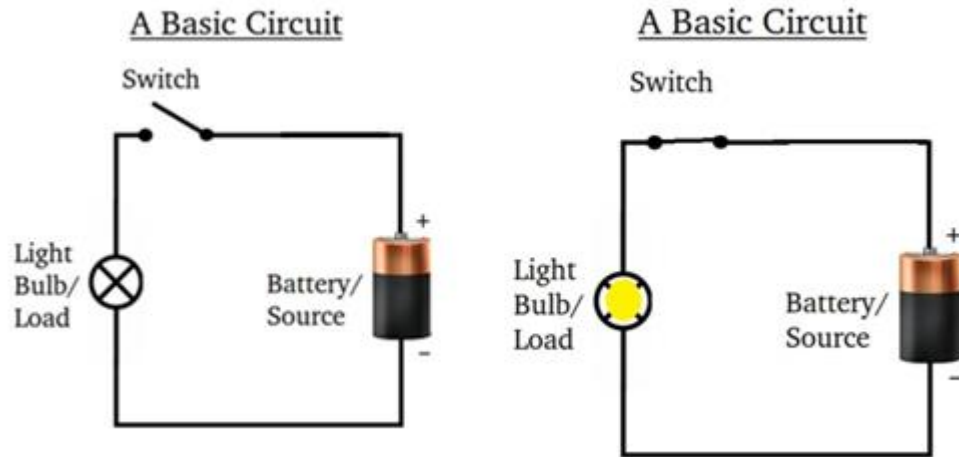
LED

Breaks if too much current goes through.
We use a resistor to limit the current.



Electronics 101

Current flows from + to - when a circuit is complete



LED

Breaks if too much current goes through.
We use a resistor to limit the current.



Electronics 101: Breadboard power

If you are going to use the ESP module, you need a power module
If using Arduino Nano, you do not need this

Connect a power source after you have finished building the prototype and verified all connections!

blue line connected to -

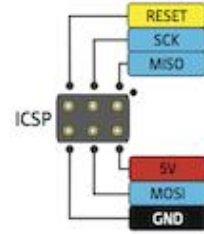
red line connected to +

If you need 5V and 3.3V power:
set 1 switch to 5V
and the other to 3.3V

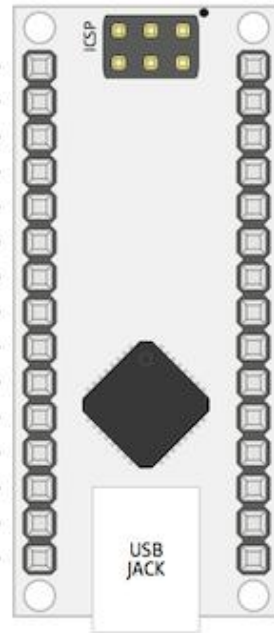
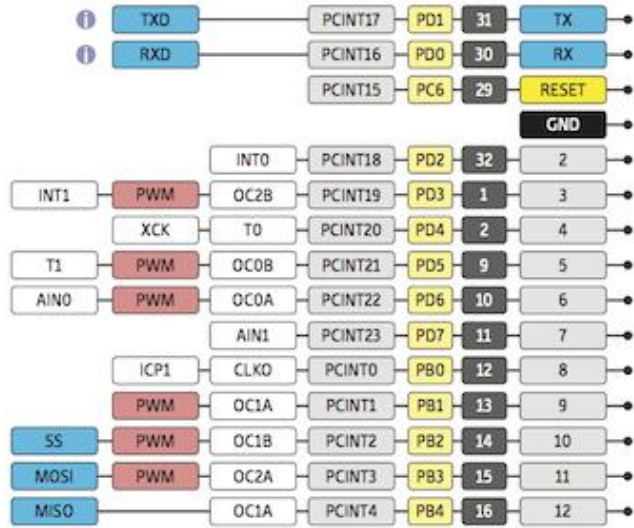


THE UNOFFICIAL
ARDUINO NANO
PINOUT DIAGRAM

- ⚠ Absolute max per pin 40mA recommended 20mA
- ⚡ Absolute max 200mA for entire package



Connected to the ATmega and used for USB program and communicating with it

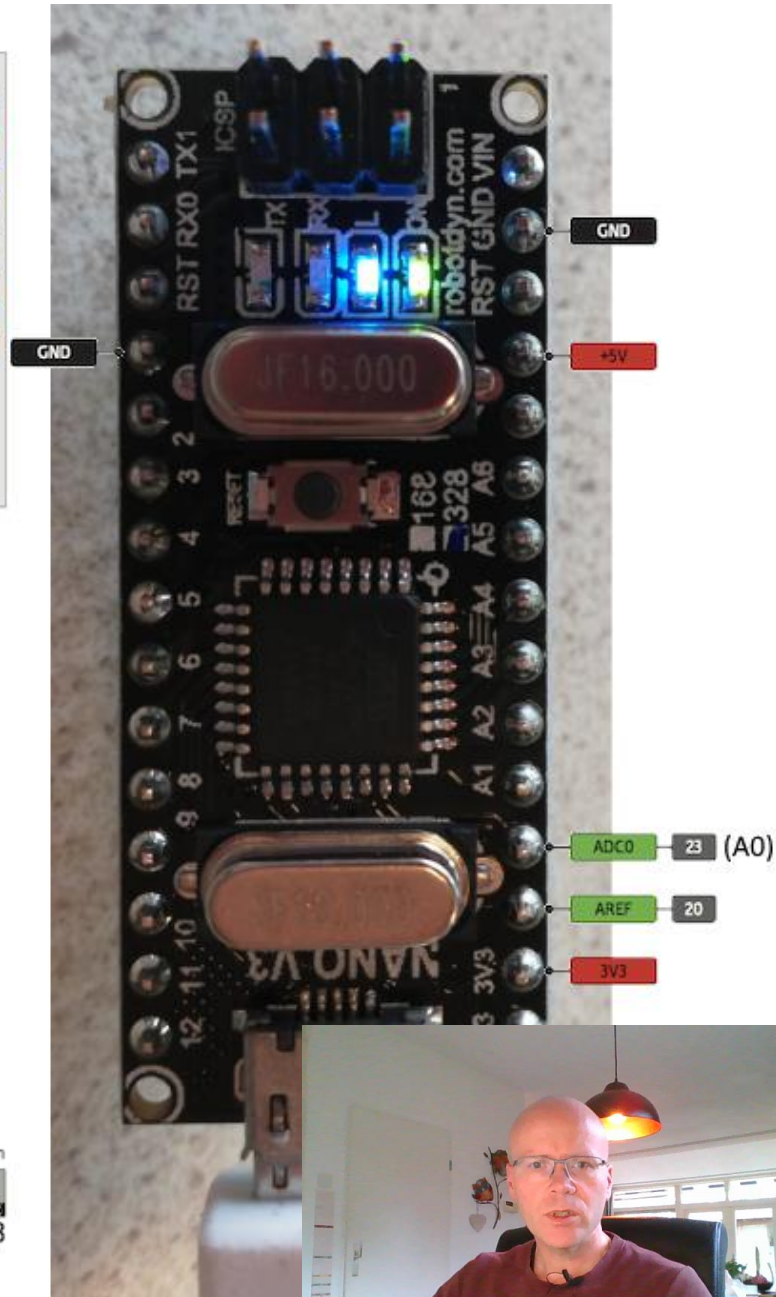


LEGEND

- GND**
- POWER**
- CONTROL**
- PHYSICAL PIN**
- PORT PIN**
- ATMEGA328 PIN FUNC**
- DIGITAL PIN**
- ANALOG-RELATED PIN**
- PWM PIN**
- SERIAL PIN**

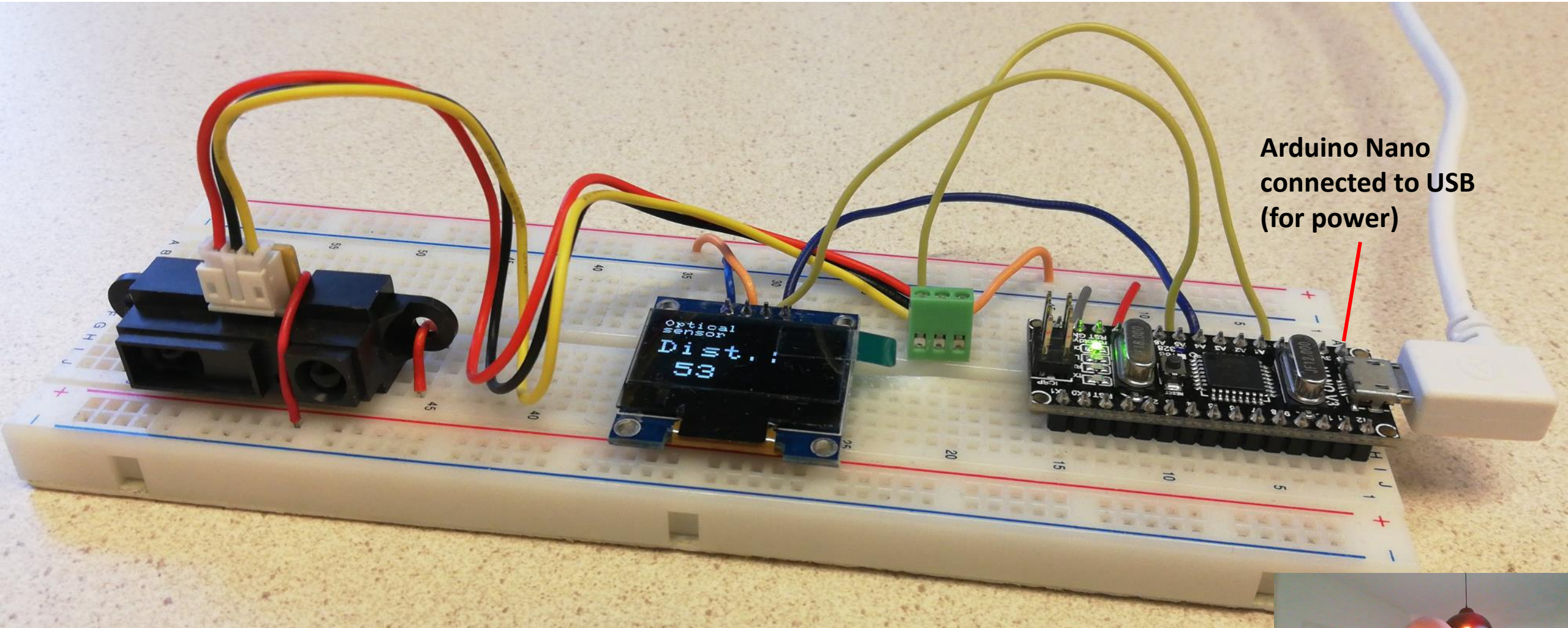
ⓘ General Information
 ⚠ Pay Attention
 ⚡ No Really PAY ATTENTION
 ⚡ LED

ⓘ On version 2 Analog Pins are reversed e.g. A0↔A7, A7↔A0



This type of Arduino comes with 5V and 3.3V power pins, so if you connect it to USB, you can use these (no power module needed), you may also use this Arduino as a power module if you do not have one at hand ;-)





Arduino Nano
connected to USB
(for power)

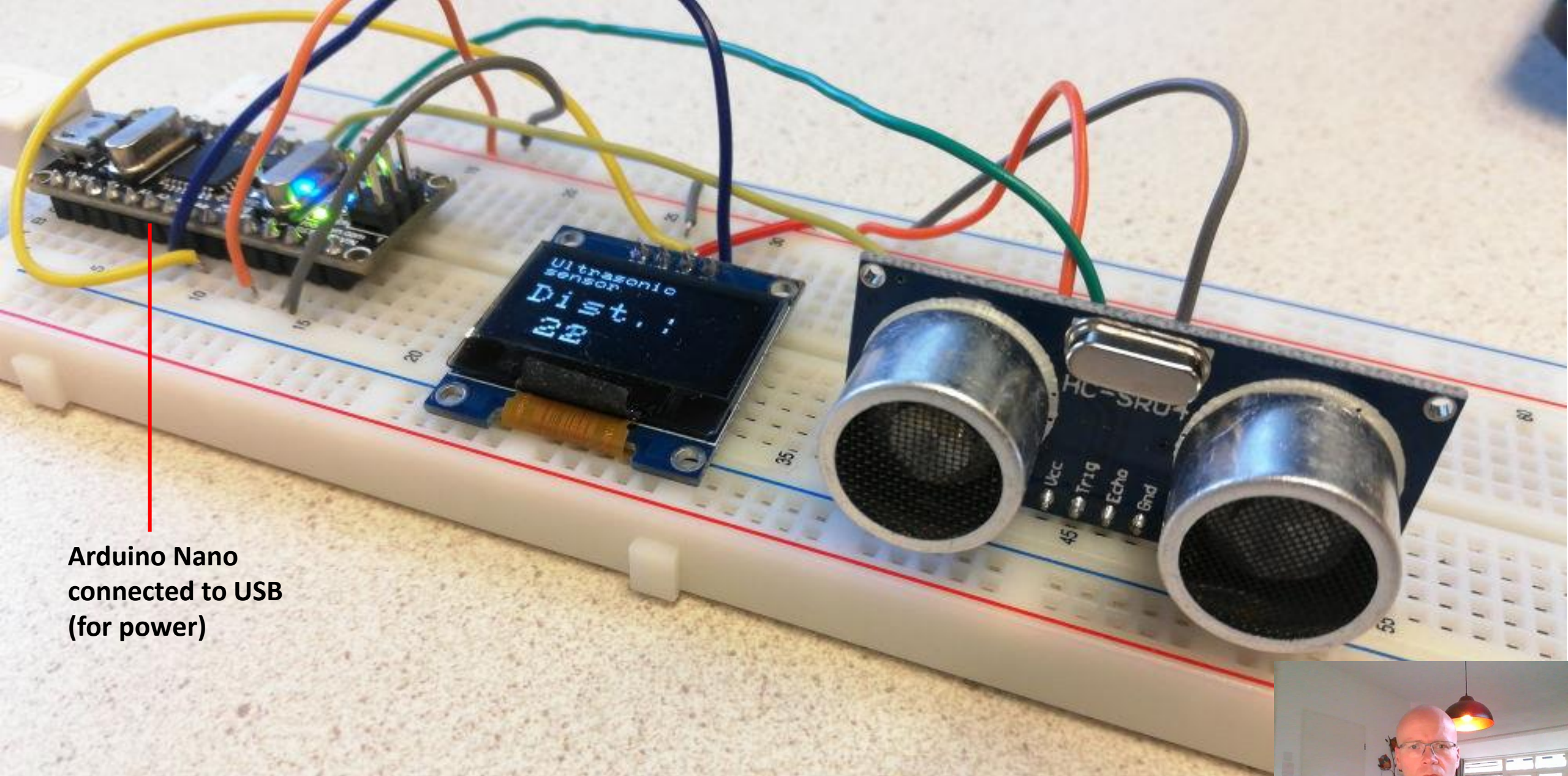
[Tutorial to build this](#)

Complete optical sensor with Arduino Nano

30/11/2020

Introduction to Sensors - Industry 4.0 with Human Touch





Arduino Nano
connected to USB
(for power)

[Tutorial to build this](#)

Complete ultrasonic sensor with Arduino Nano



[Tutorial to build this](#)

Connect to battery, _____
or connect usb cable at other end

set switch to 5V

power module

Ultrasonic sensor MUST be
connected to 5V

set switch to 3.3V

Connect to USB cable for power,
or connect battery at other end

connection to GND

3.3V line connected to
3V pin of ESP32 module

ESP module

Complete sensor with ESP module

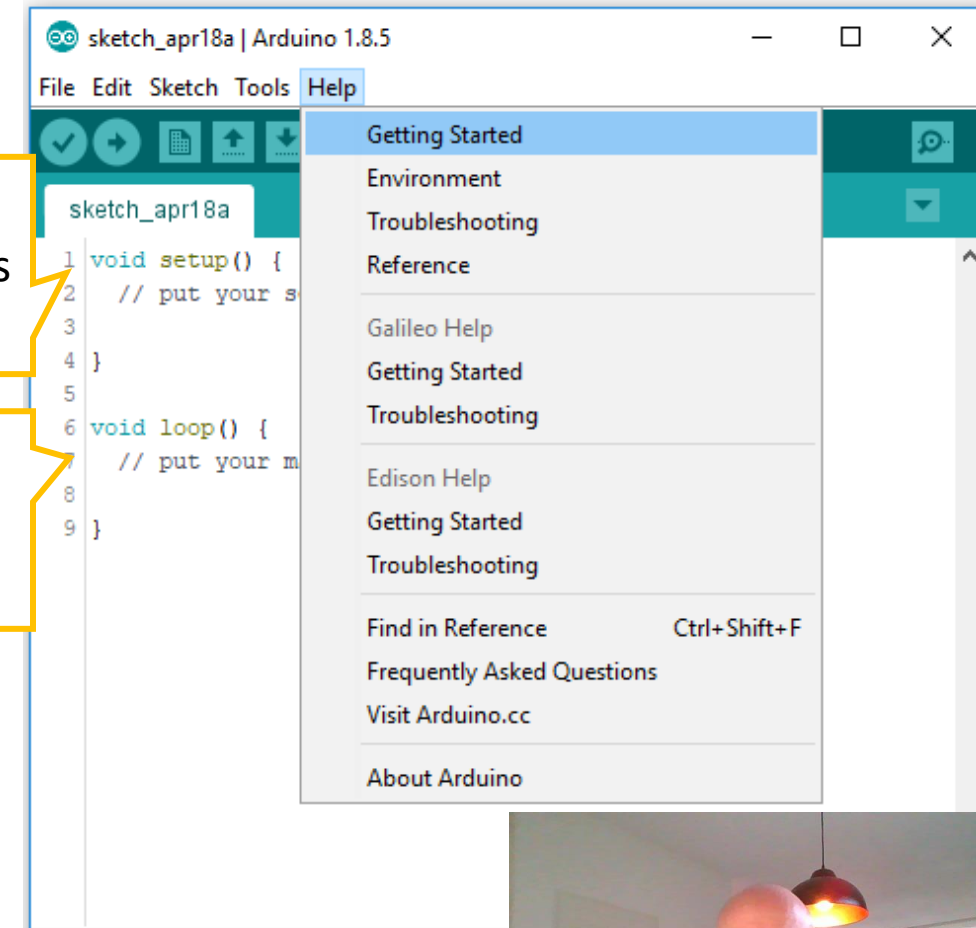


Arduino programming

- Arduino program also called: **sketch**
- Language: C++ (similar to Java)
- Download & install Arduino Desktop IDE @ arduino.cc/en/Guide
- Start with Examples: arduino.cc/en/Tutorial/BuiltInExamples
- ... or use examples from practical

setup(): start of program, runs once

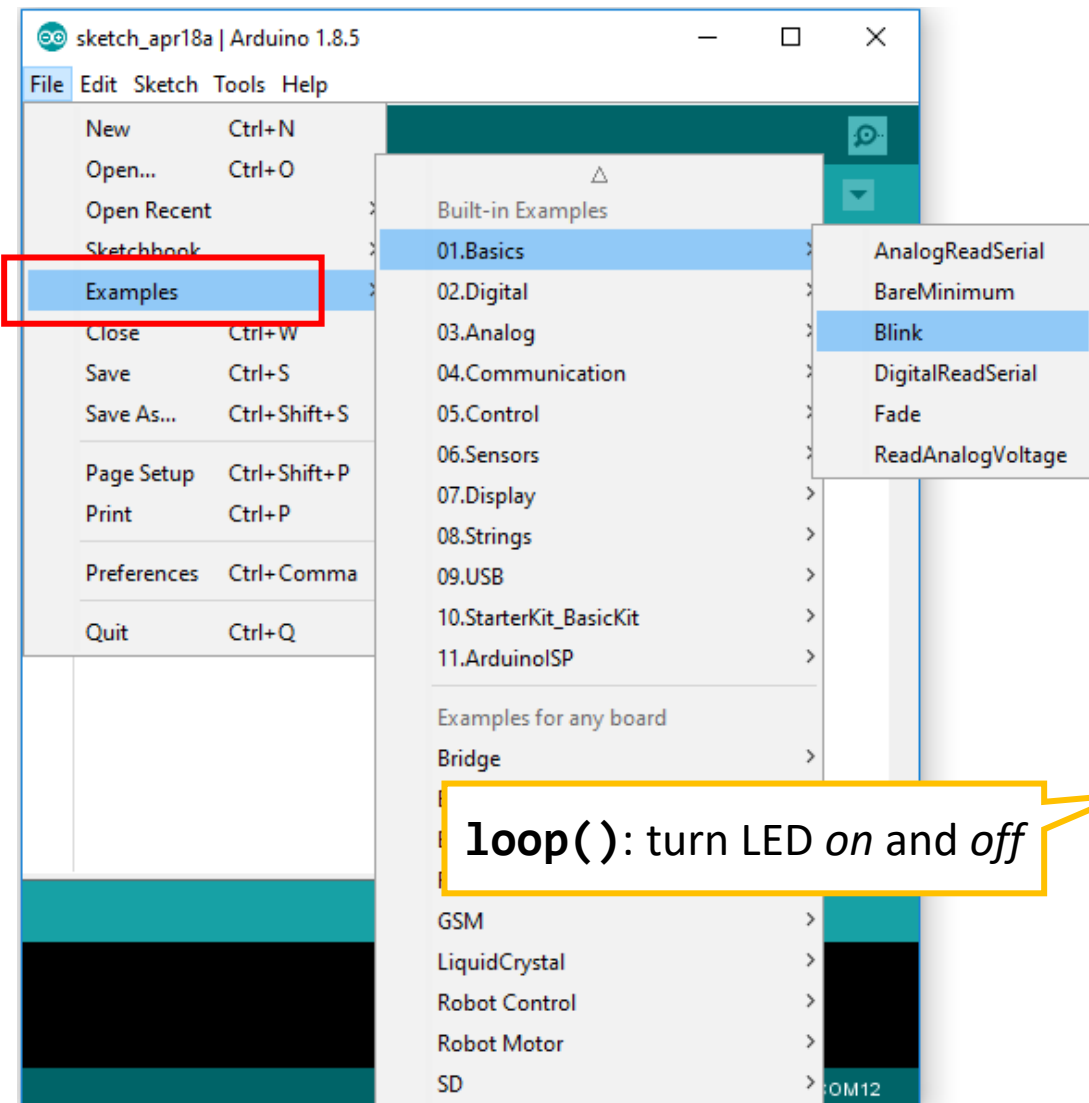
loop(): runs continuously after setup()



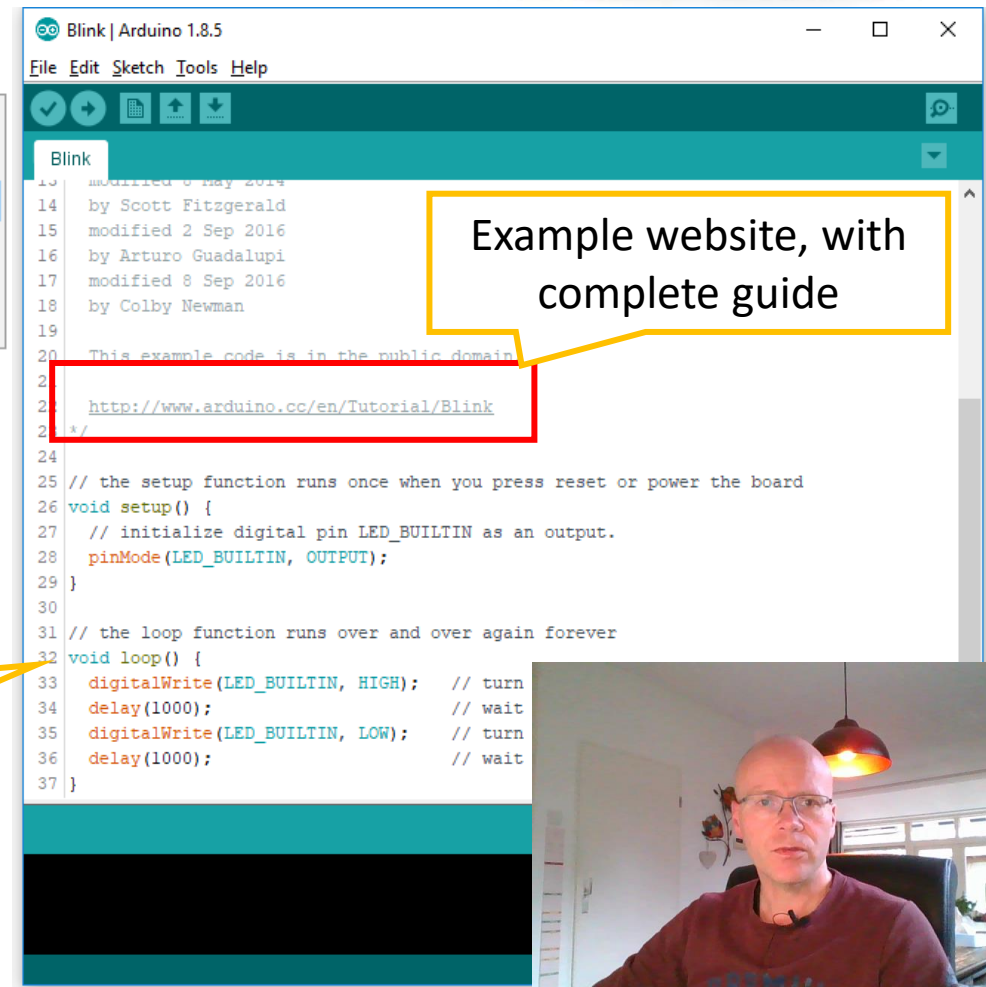
Learn from examples



LED_BUILTIN is the LED on the board



loop(): turn LED on and off



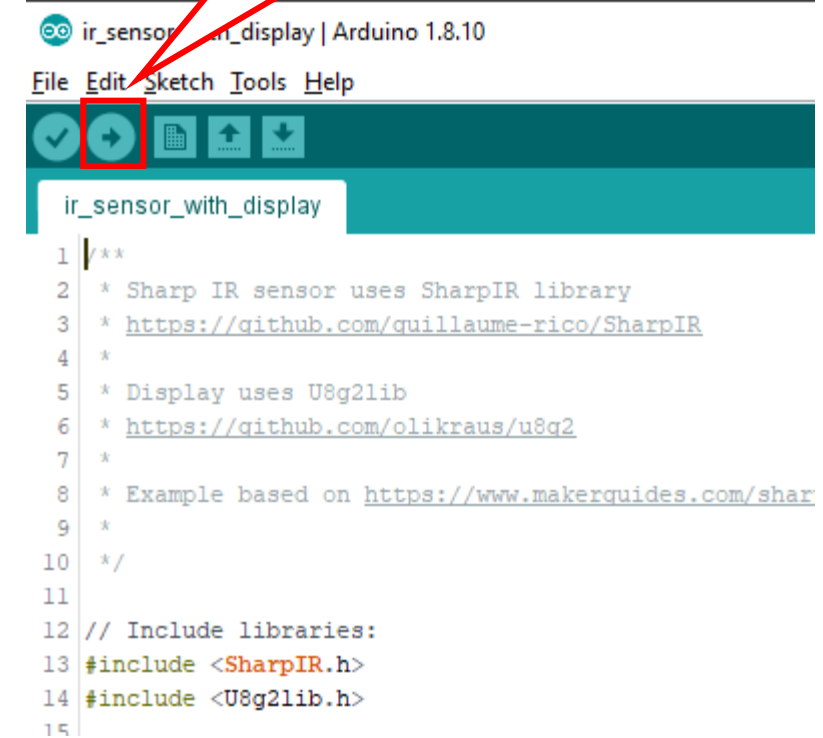
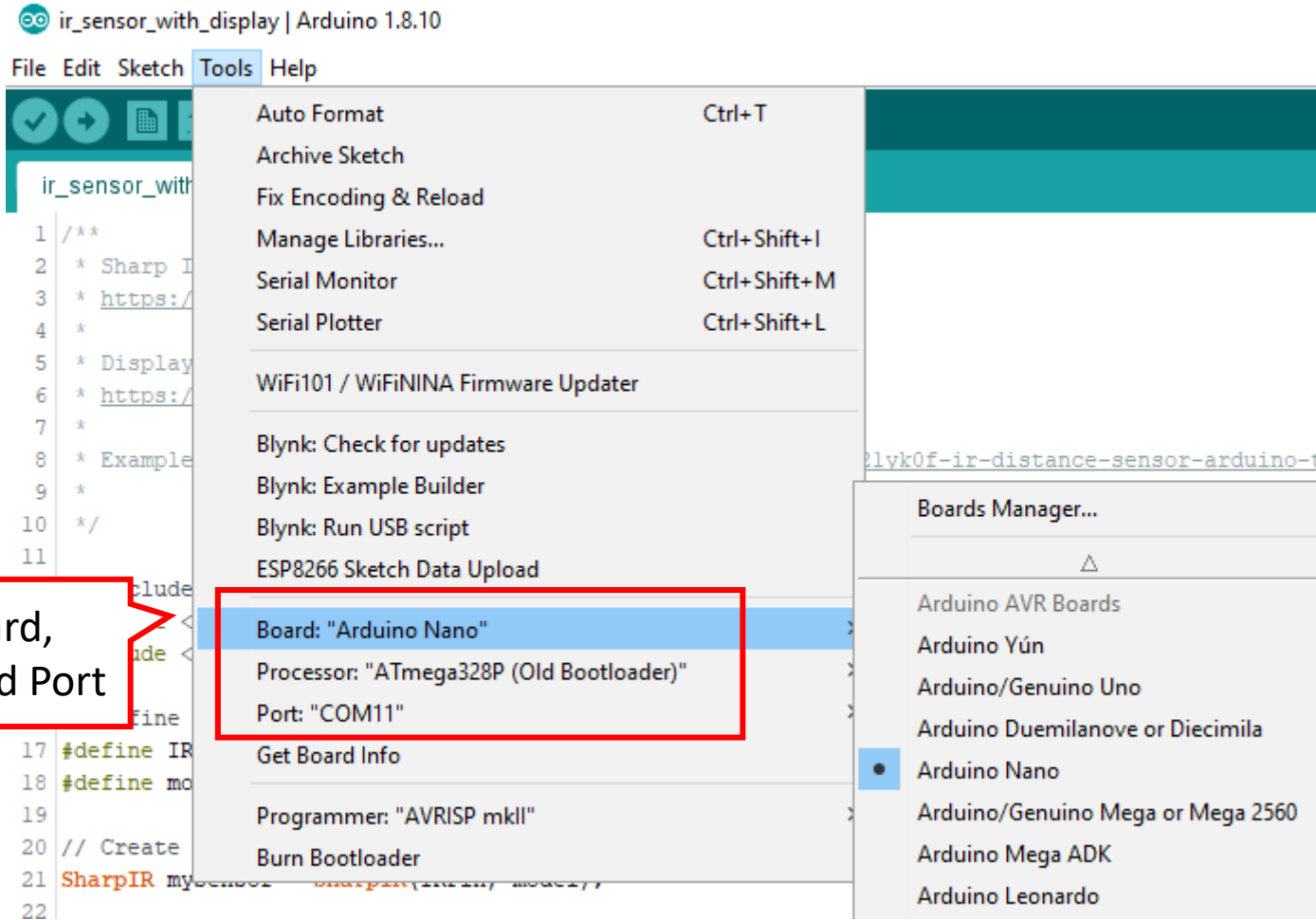
Example website, with complete guide



Run a program

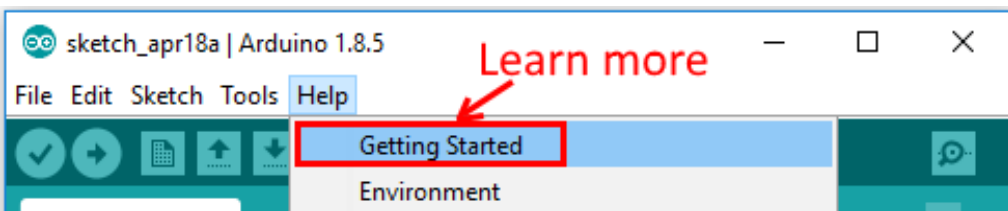
Connect USB cable first!

Click Upload



Select Board, Processor and Port

Learn more



ction to Sensors - Industry 4.0 with Human Touch



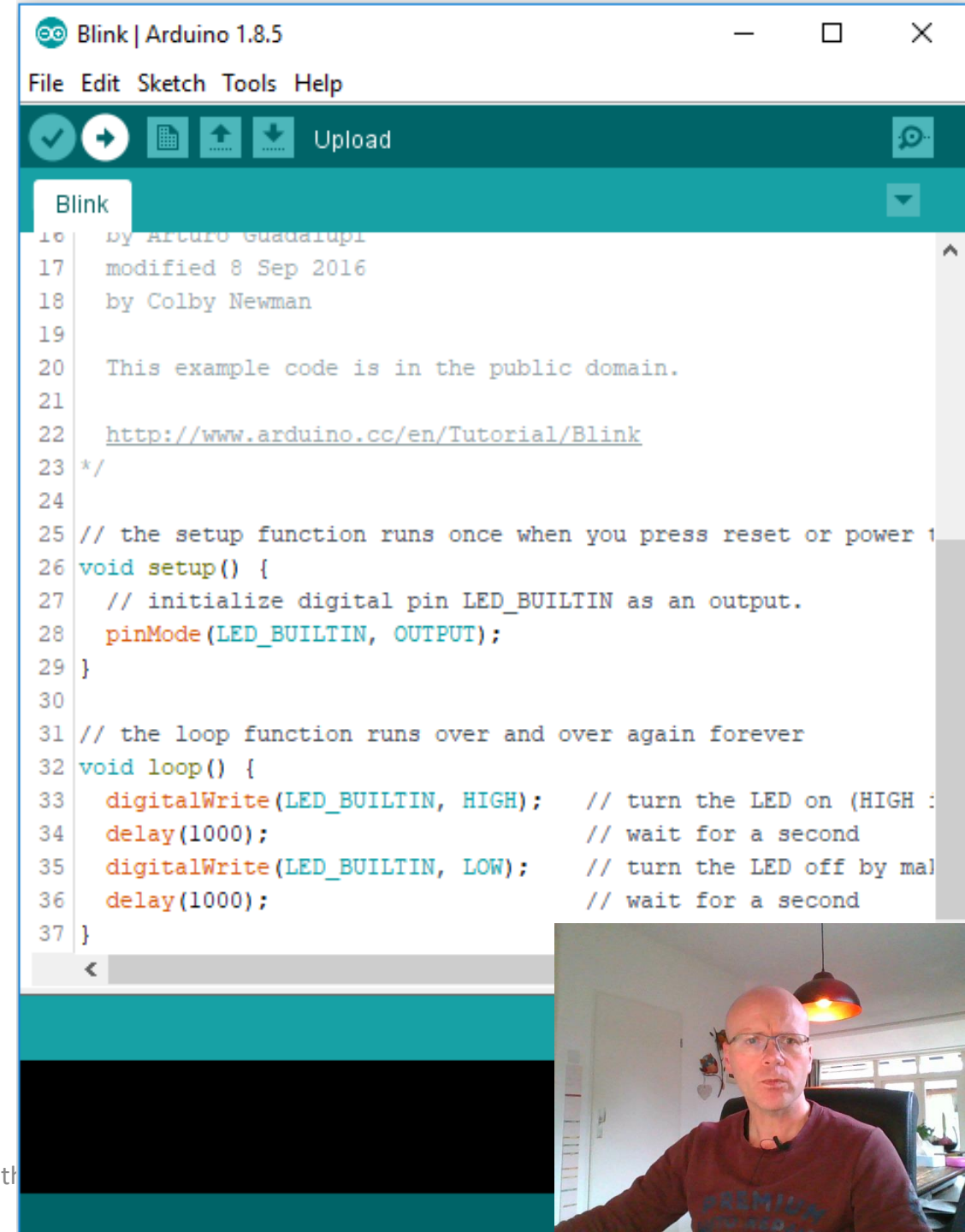
Programming

Initialize LED_BUILTIN pin as an output pin with:

```
pinMode(LED_BUILTIN, OUTPUT);
```

In the main loop, you turn the LED on with:

```
digitalWrite(LED_BUILTIN, HIGH);
```



Practical session

Get a 'sense' 😊 of what is involved in selecting, implementing and testing sensors

Build a sensor, test it, do some measurements (determine accuracy, validity, reliability)

Evaluate/reflect

Apply what you learned to project assignment:

- What kind of questions can be formulated regarding sensors/sensing in the quick scan?
- What can be used to improve the “Educational quick scan Industry 4.0”? (e.g. the Measurement questions)
- What can be used from this lecture/practical to create and advise on how to achieve a greater industry 4.0 maturity (future state)?

[Goto vanslooten.com/i40/sensor-practical to do the practical](https://vanslooten.com/i40/sensor-practical)



QUESTIONS?

vanslooten.com/i40

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