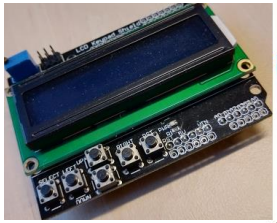
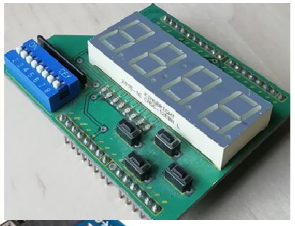
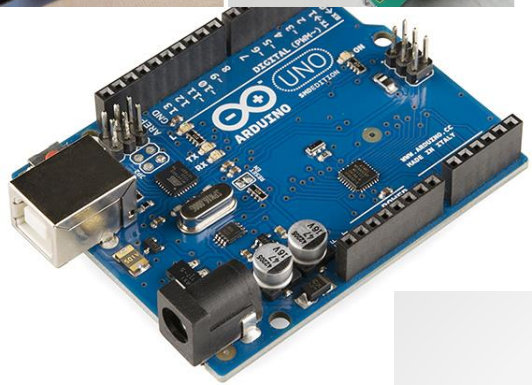
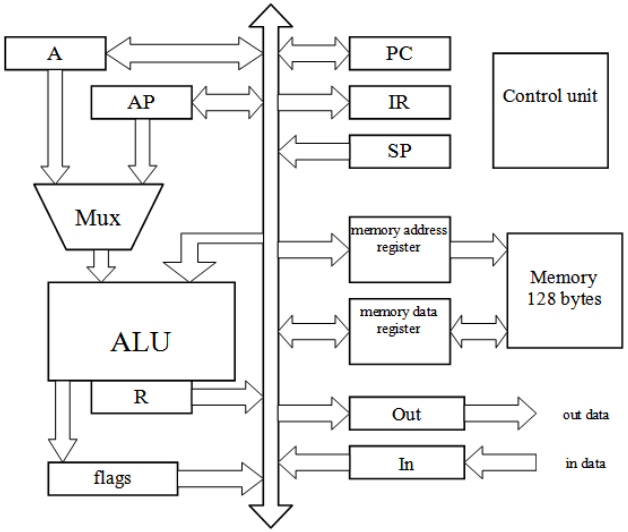
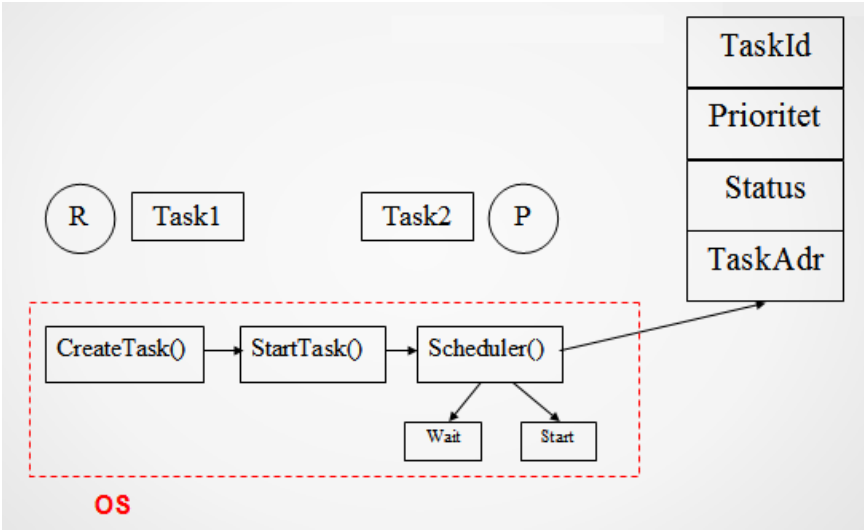
Real-time programming





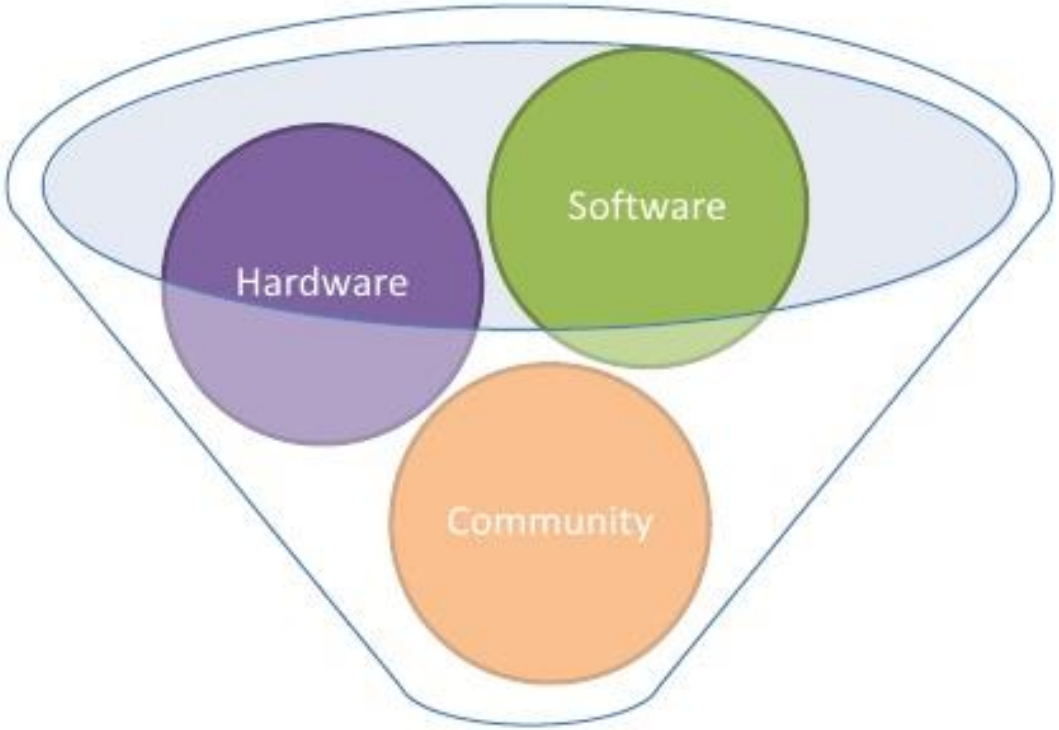






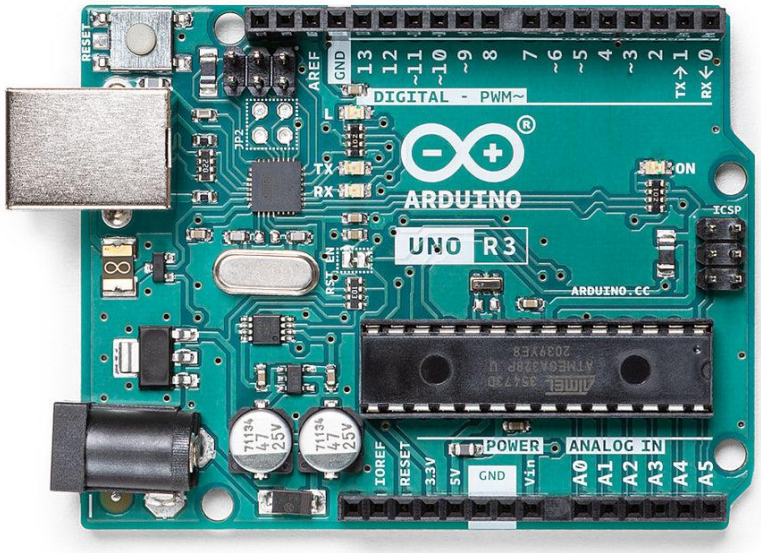
Arduino intro

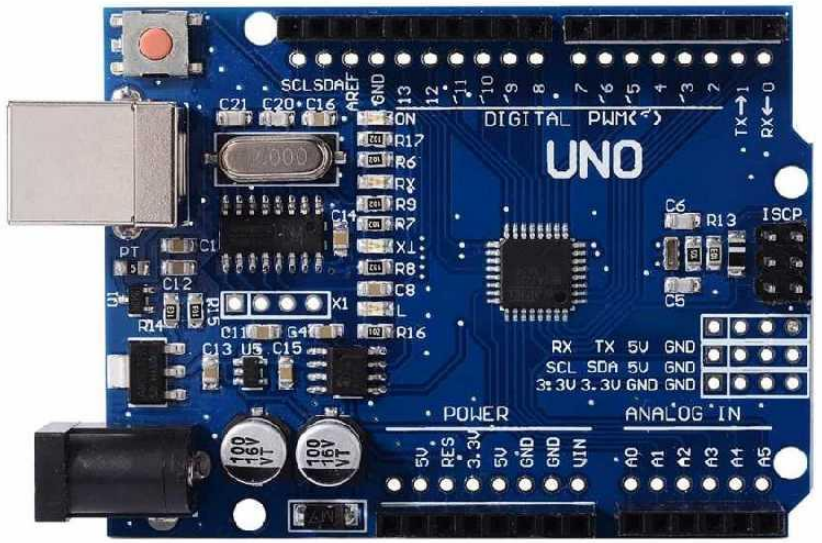
Successful mashup



Arduino!

What is Arduino (Uno)?





-Arduino is an **Open Source** platform – development system.

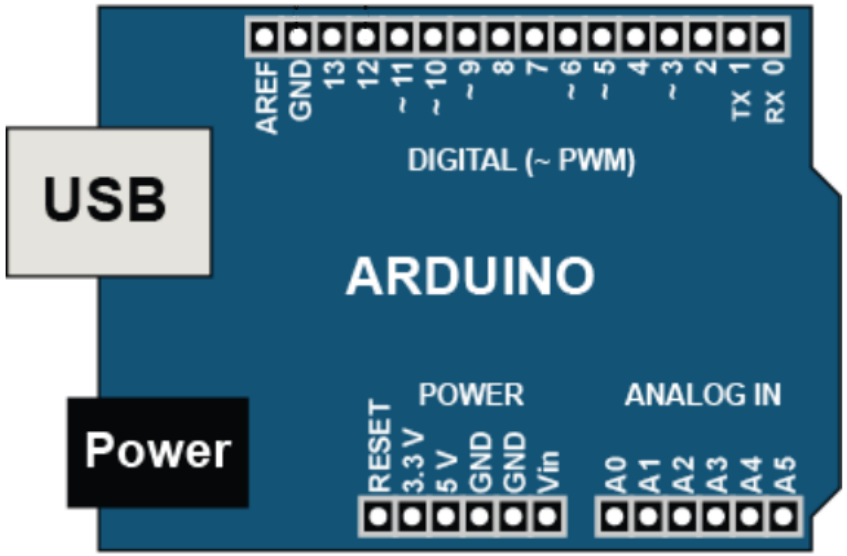
-Easy to use.

-Easy to programm.

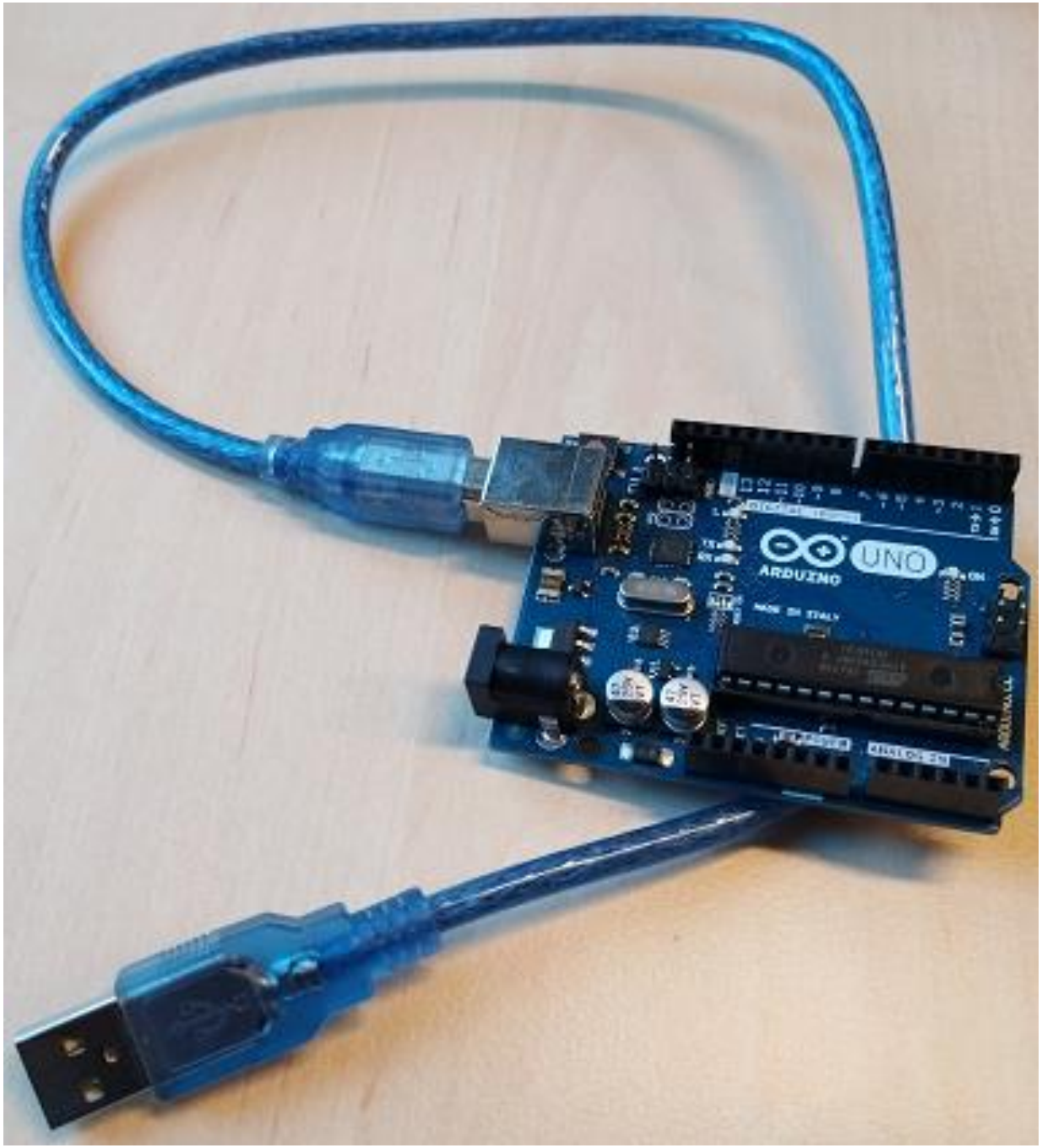
-Fast prototyping.

-Build around Atmel AVR microcontroller.

-To work with USB cabel, and later shields are needed.



Arduino Uno



Official Arduino family

Arduino Uno

Arduino Leonardo

Arduino Due

Arduino Yún

Arduino Tre

Arduino Micro

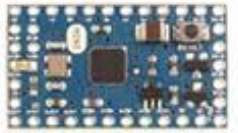
Arduino Robot

Arduino Esplora

Arduino Mega ADK

Arduino Ethernet

Arduino Mega 2560

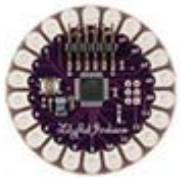


Arduino Mini

LilyPad Arduino USB

LilyPad Arduino Simple

LilyPad Arduino SimpleSnap



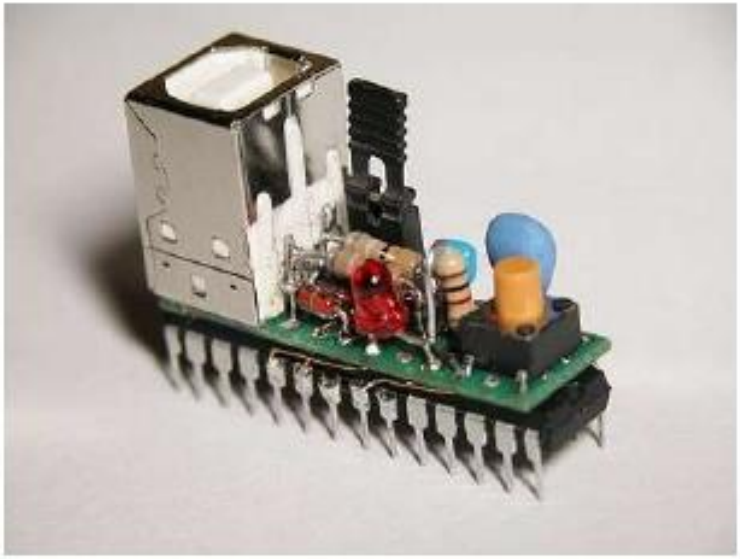
LilyPad Arduino

Arduino Nano

Arduino Pro Mini

Alternative forms

Alternative form factors ☺



- **One-Chip Arduino**

  http://bit.ly/WXqeU

- **Breadboard Arduino**

  http://bit.ly/7QMkbx

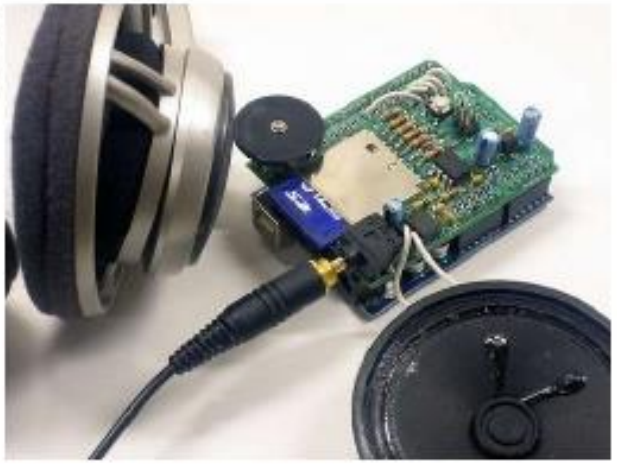
Arduino Shields

(1)

(3)

(2)

(4)

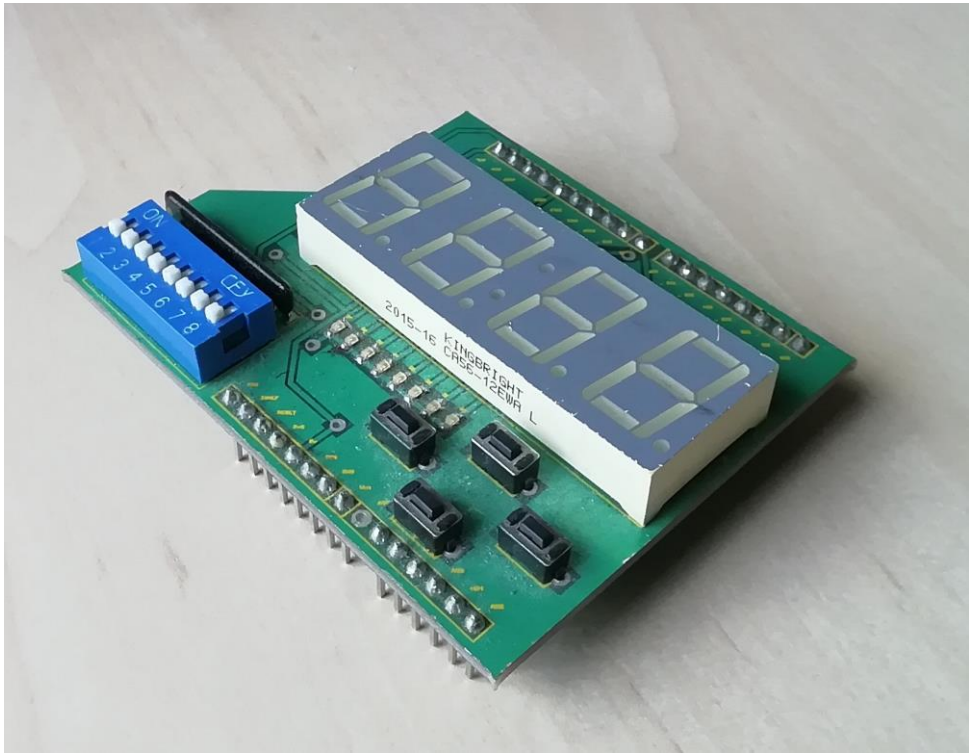


[1] Adafruit Motor Shield - http://ladyada.net/make/mshield/index.html
[2] Nu Electronics LCD shield - http://www.nuelectronics.com/estore/index.php?main_page=product_info&cPath=1&products_id=2
[3] Arduino Ethernet Shield - http://arduino.cc/en/Main/ArduinoEthernetShield
[4] Adafruit Wave Shield - http://ladyada.net/make/waveshield/index.html

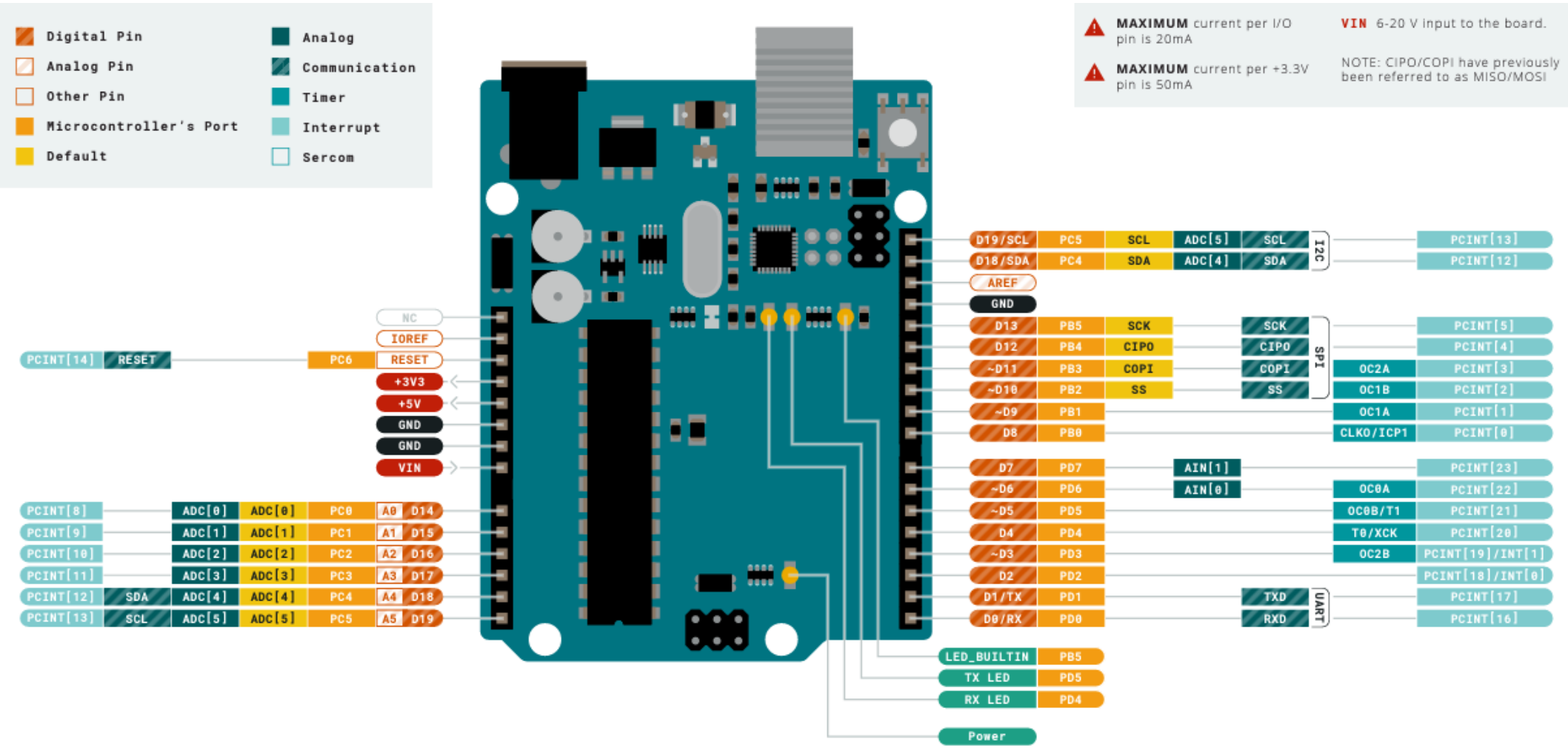
More? :-)

Our shields

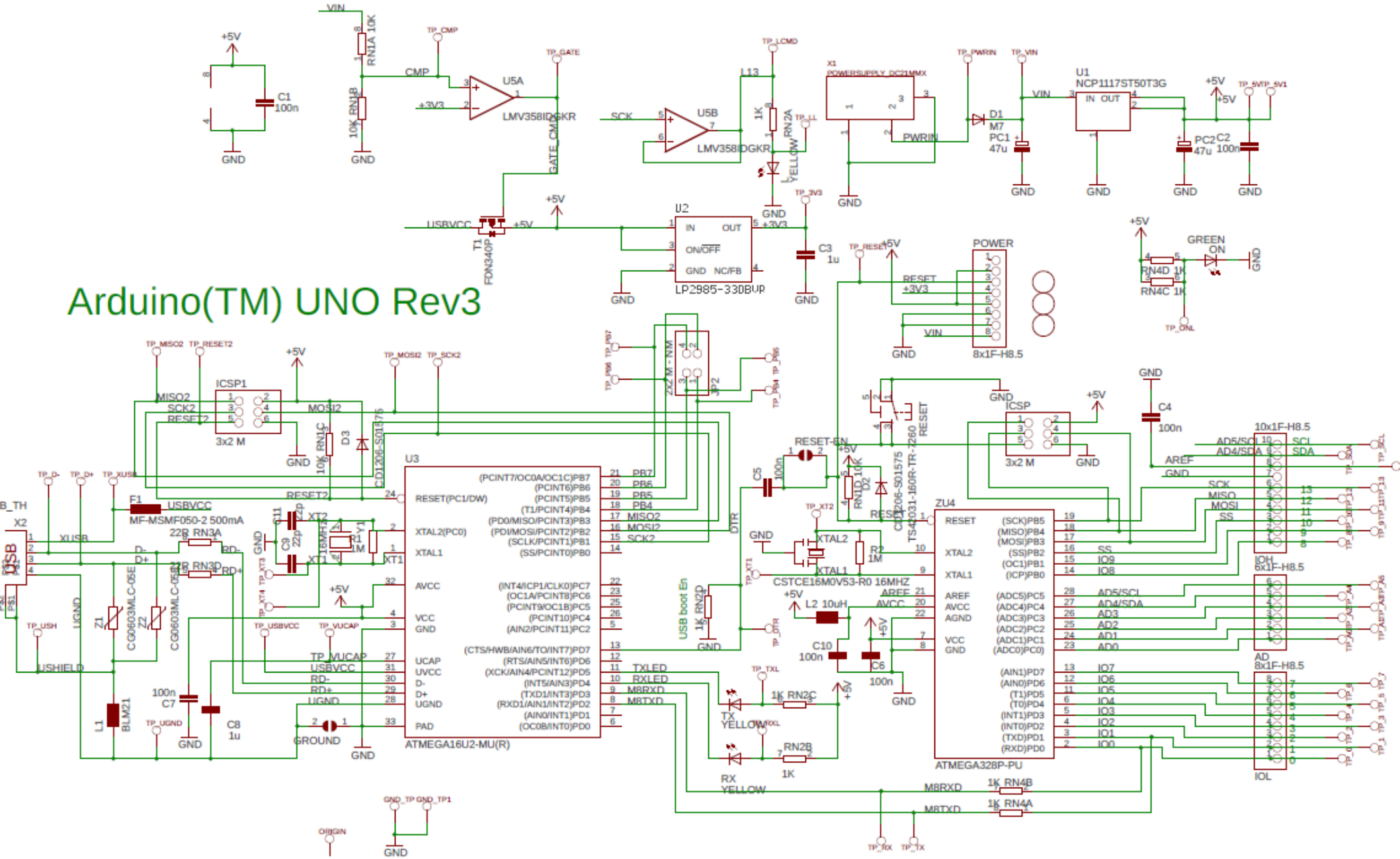

LCD Keypad Shield
SELECT
LEFT
UP
DOWN
RIGHT
RST
VIN


ON
KINGBRIGHT

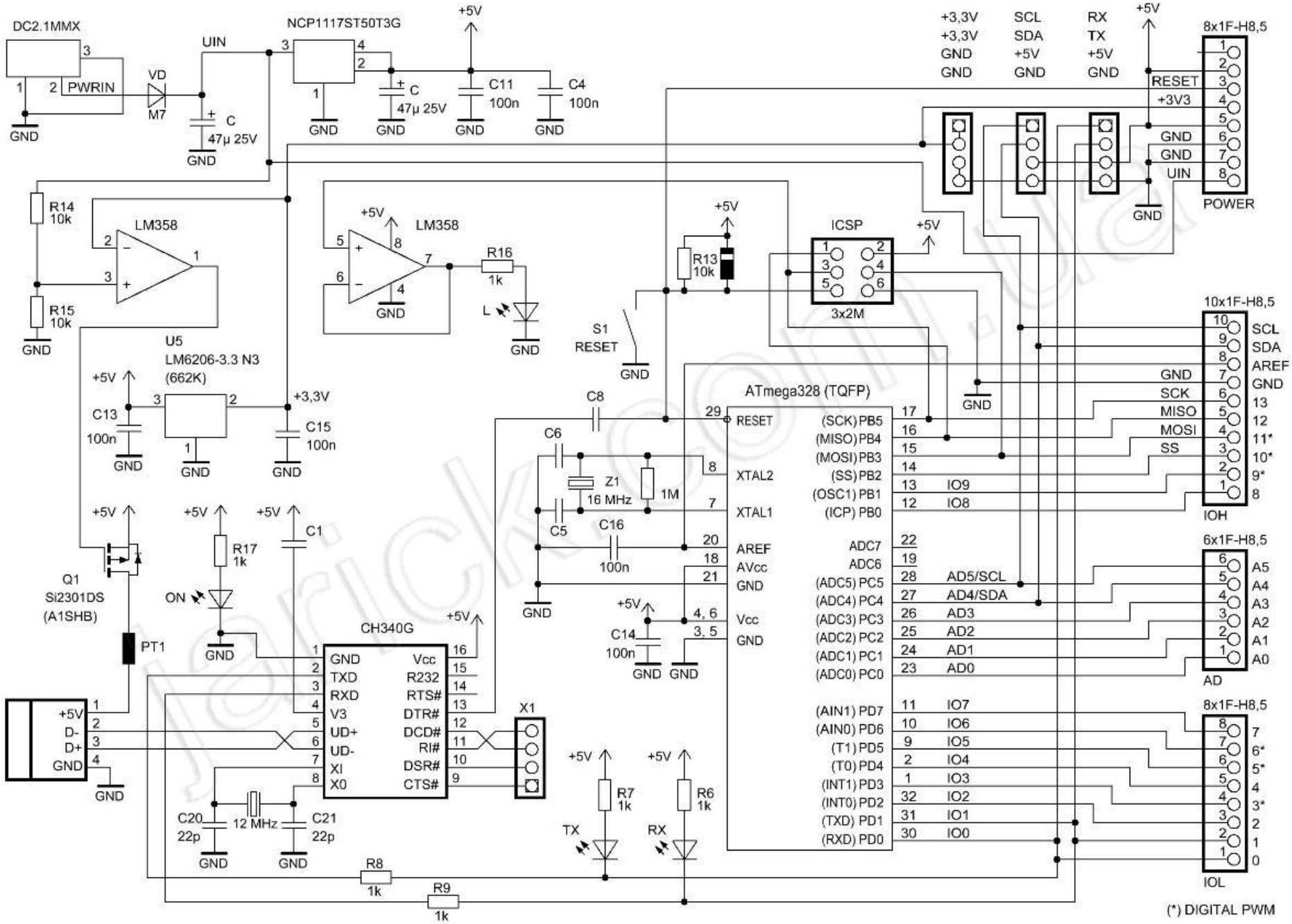
Pinout


Digital Pin
Analog Pin
Other Pin
Microcontroller's Port
Default
Analog
Communication
Timer
Interrupt
Sercom
MAXIMUM current per I/O pin is 20mA
MAXIMUM current per +3.3V pin is 50mA
VIN 6-20 V input to the board.
NOTE: CIPO/COPI have previously been referred to as MISO/MOSI
NC
IOREF
PCINT[14] RESET
PC6 RESET
+3V3
+5V
GND
GND
VIN
PCINT[8] ADC[0] ADC[0] PC0 A0 D14
PCINT[9] ADC[1] ADC[1] PC1 A1 D15
PCINT[10] ADC[2] ADC[2] PC2 A2 D16
PCINT[11] ADC[3] ADC[3] PC3 A3 D17
PCINT[12] SDA ADC[4] ADC[4] PC4 A4 D18
PCINT[13] SCL ADC[5] ADC[5] PC5 A5 D19
D19/SCL PC5 SCL ADC[5] SCL I2C PCINT[13]
D18/SDA PC4 SDA ADC[4] SDA I2C PCINT[12]
AREF
GND
D13 PB5 SCK SCK SPI PCINT[5]
D12 PB4 CIPO CIPO SPI PCINT[4]
~D11 PB3 COPI COPI SPI OC2A PCINT[3]
~D10 PB2 SS SS SPI OC1B PCINT[2]
~D9 PB1 OC1A PCINT[1]
D8 PB0 CLKO/ICP1 PCINT[0]
D7 PD7 AIN[1] PCINT[23]
~D6 PD6 AIN[0] OC0A PCINT[22]
~D5 PD5 OC0B/T1 PCINT[21]
D4 PD4 T0/XCK PCINT[20]
~D3 PD3 OC2B PCINT[19]/INT[1]
D2 PD2 PCINT[18]/INT[0]
D1/TX PD1 TXD UART PCINT[17]
D0/RX PD0 RXD UART PCINT[16]
LED_BUILTIN PB5
TX LED PD5
RX LED PD4
Power

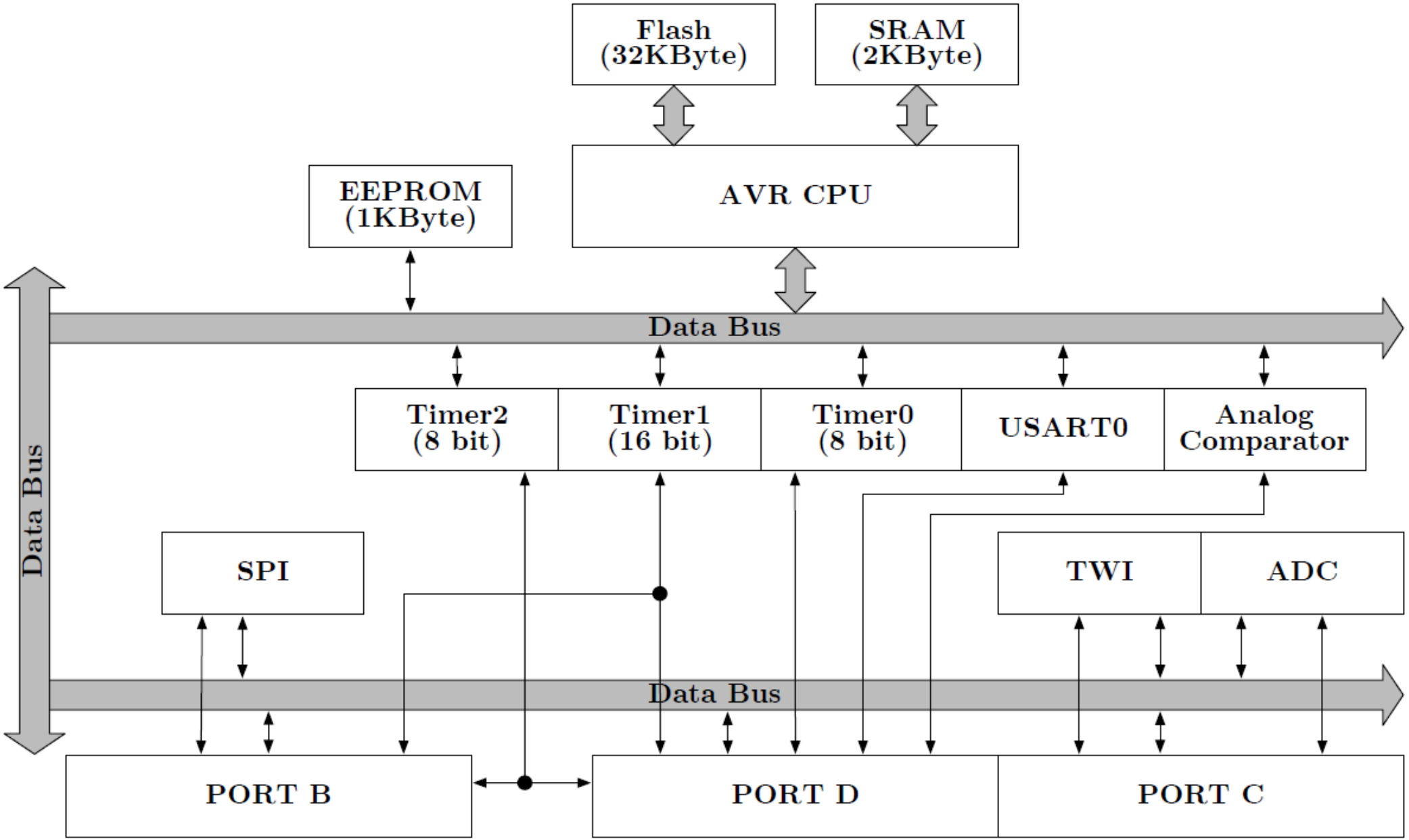
Electronic schematic (official)



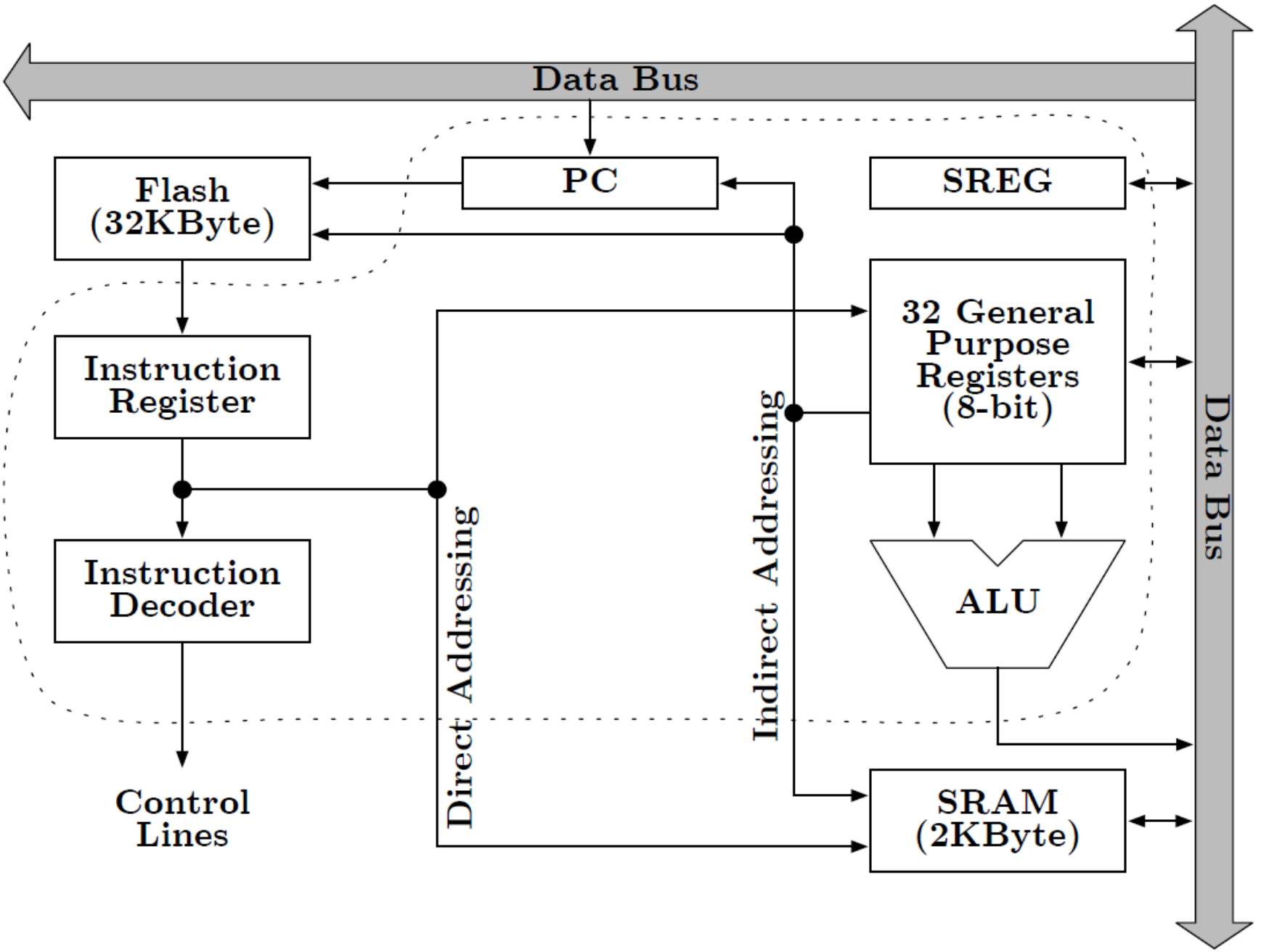
Electronic schematic (unofficial)



Blok diagram of ATMega328p



CPU


Data Bus
Flash
(32KByte)
PC
SREG
Instruction
Register
32 General
Purpose
Registers
(8-bit)
Instruction
Decoder
ALU
Control
Lines
Direct Addressing
Indirect Addressing
SRAM
(2KByte)
Data Bus

Software

-Arduino IDE

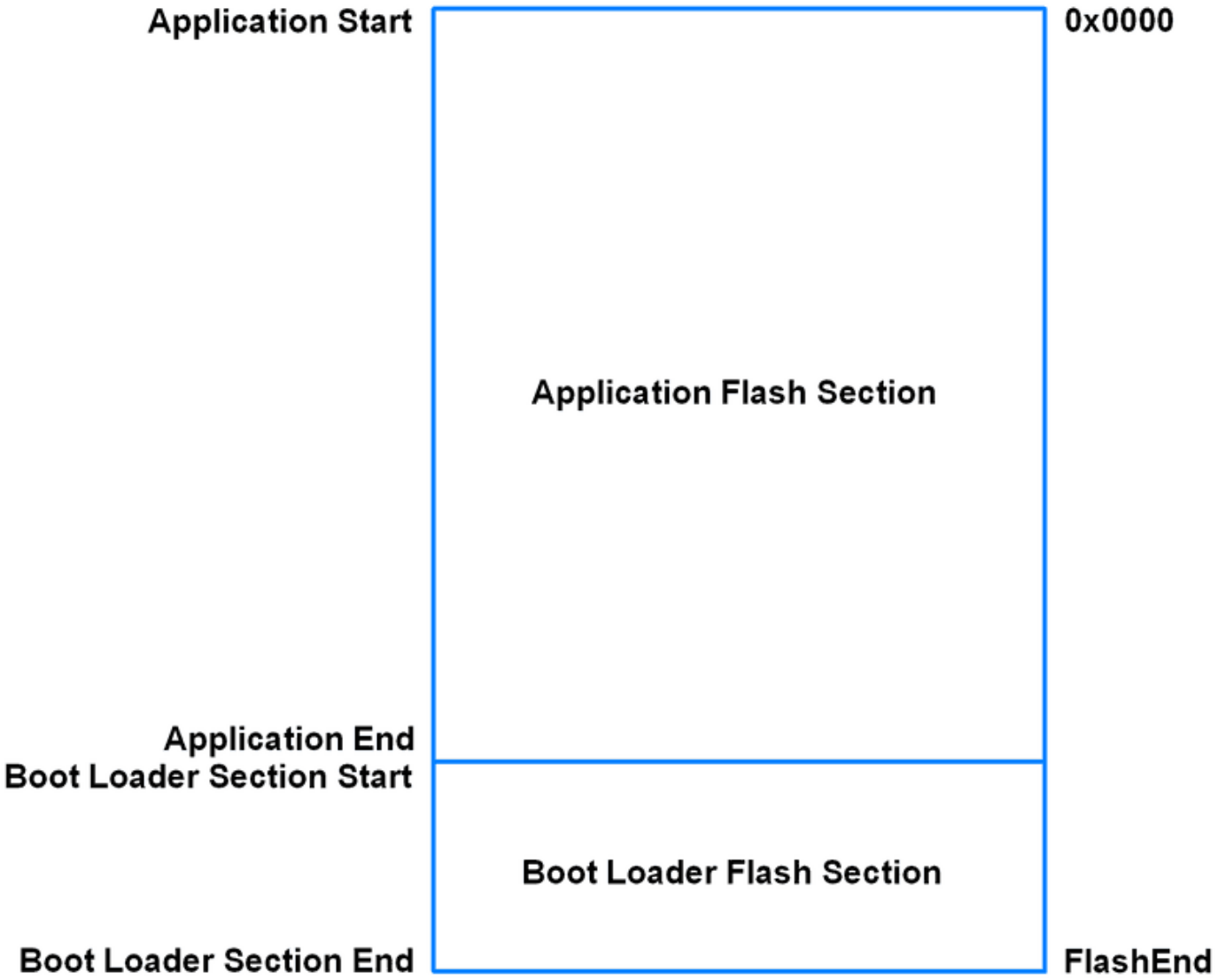
-Eclipse IDE

-Arduino IDE: https://www.arduino.cc/en/Main/Software

-Similar to C++, but much simpler

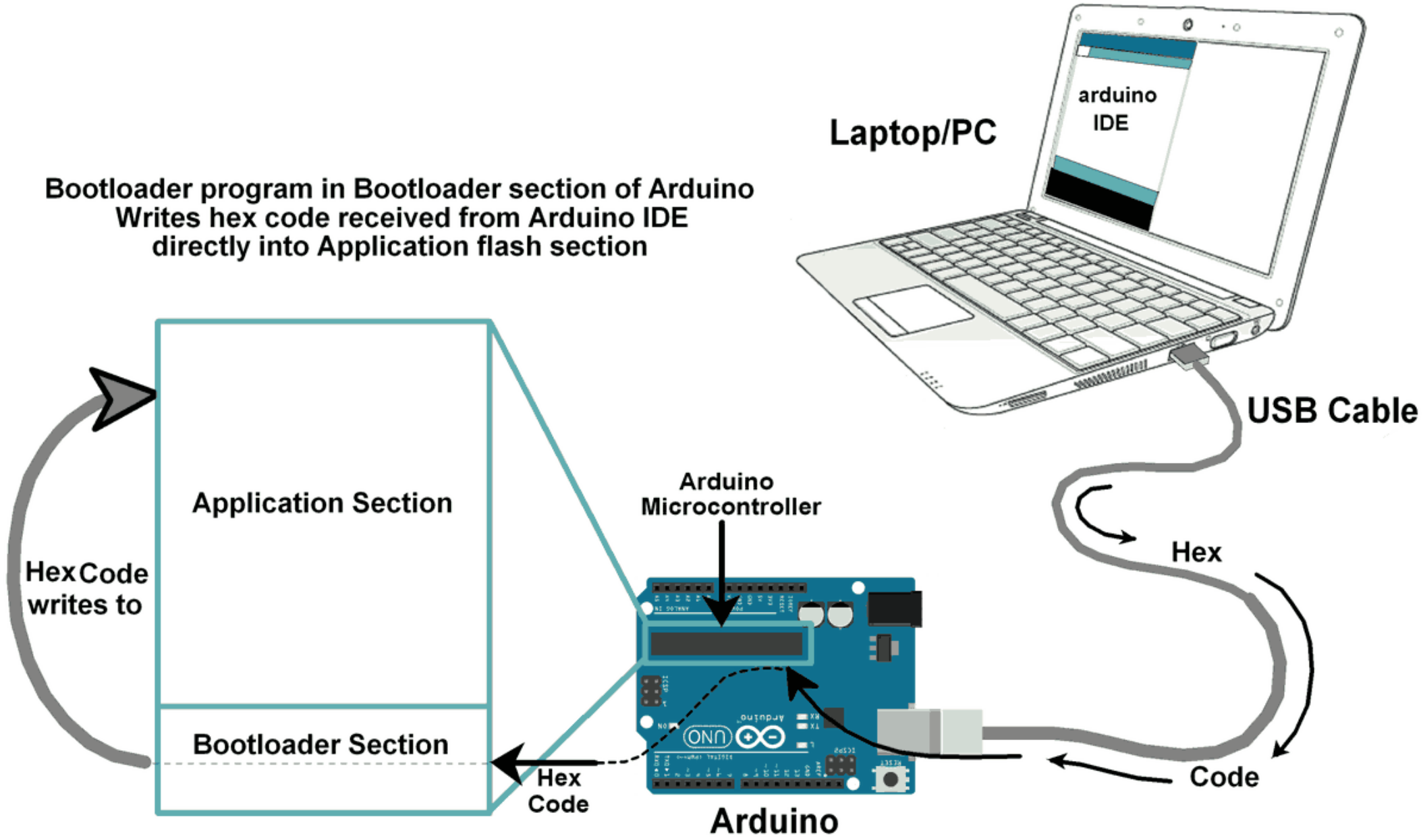
-After successful compile, the code is uploaded to the Arduino Uno board (it has Bootloader).

Bootloader



https://www.electronicwings.com/arduino/basics-to-developing-bootloader-for-arduino

Bootloader



https://www.electronicwings.com/arduino/basics-to-developing-bootloader-for-arduino

Arduino IDE

Example 1 (Sketch 1)
Minimal Arduino sketch.

Solution:

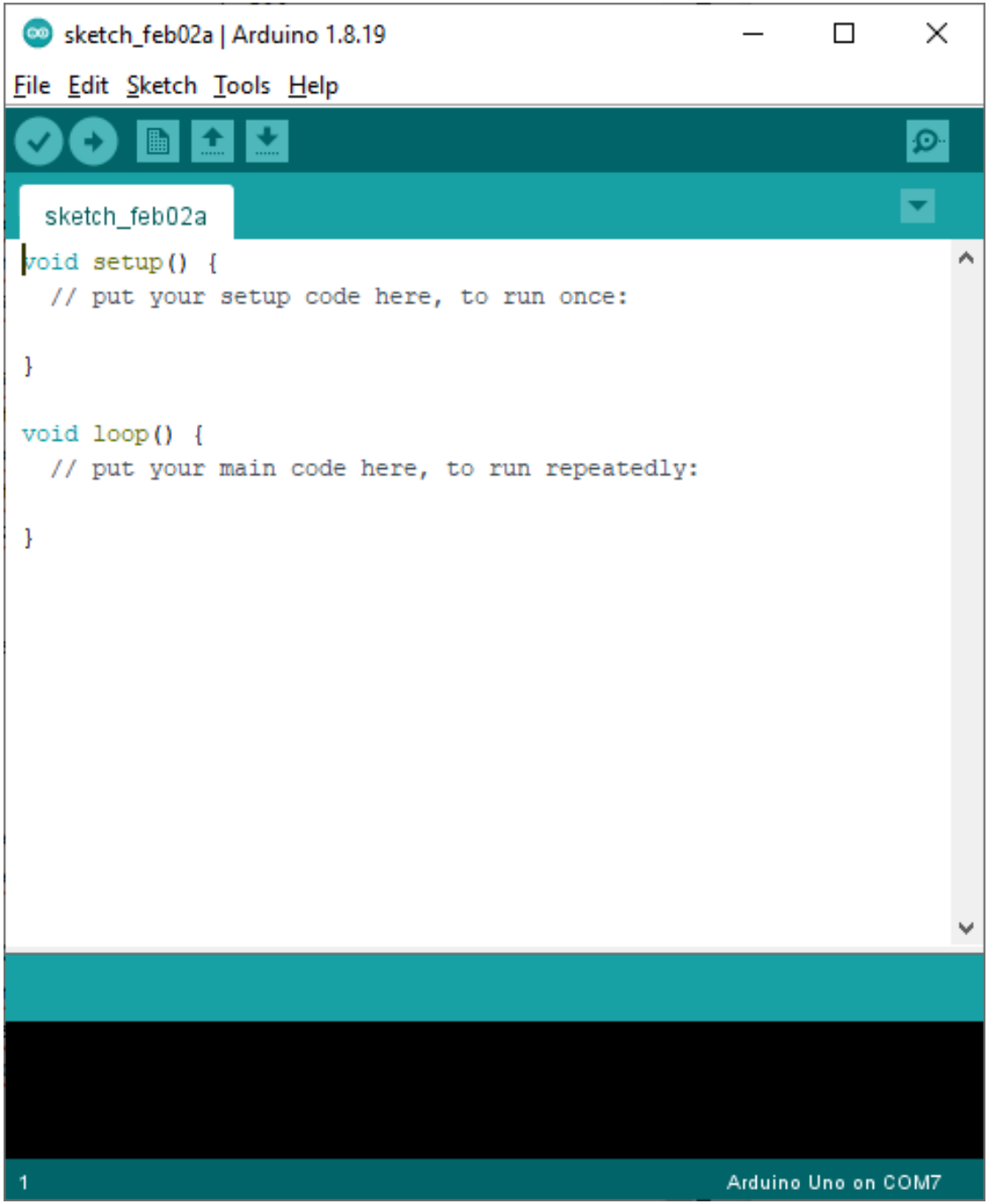
It consists of one `setup()`kIt is called once at the beginning one infinite loop `loop()`uin which is main program executed.

```
void setup() {

}

// infinite loop
void loop() {

}
```



Setup, Loop

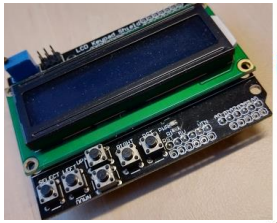
`Setup()`: it is called once upon Arduino power up or after RESET button is pressed. It is used for initialization.

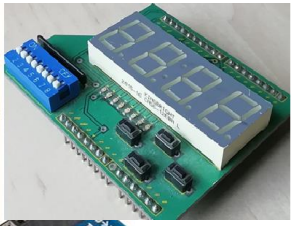
`Loop ()`: this function is executed repeatedly until power supply goes is shut down. Inside is the main program logic. It is similar to `while(1)` loop used in other IDEs.

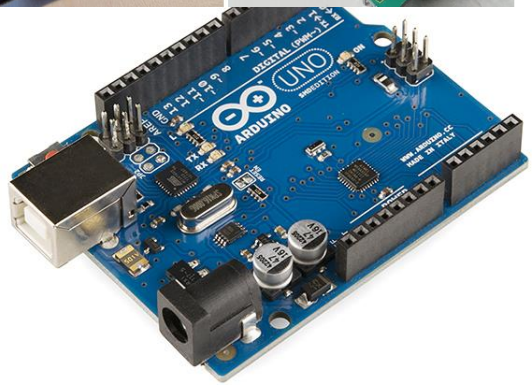
TED talk Massimo Banzi

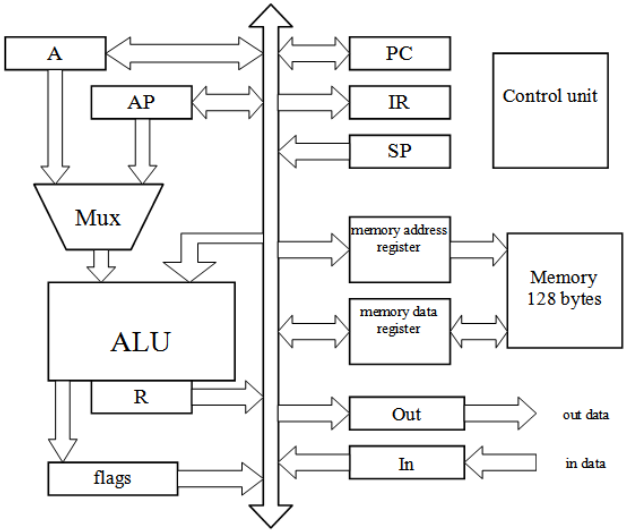
https://www.youtube.com/watch?v=UoBUXOOdLXY

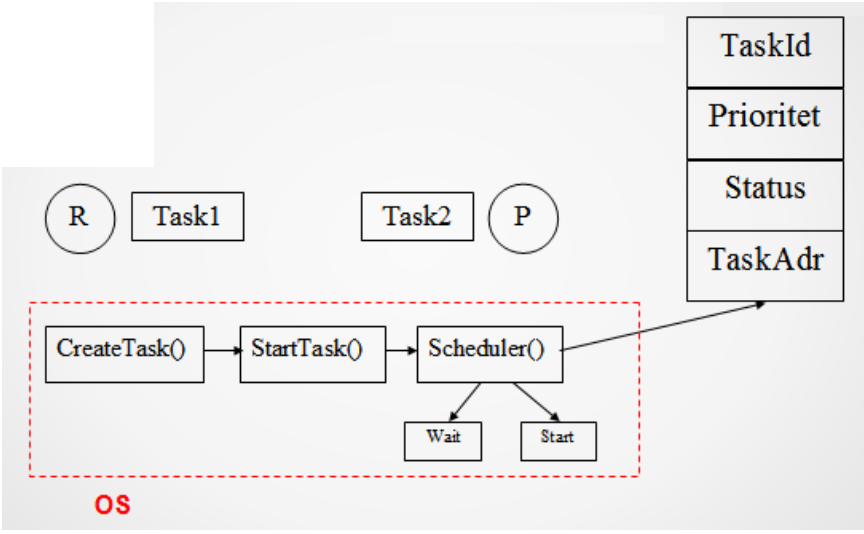
RTP











Thanks for your attention!