
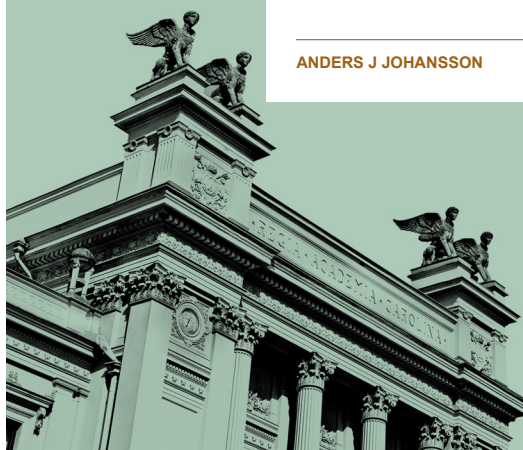


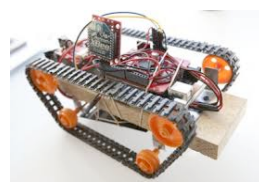
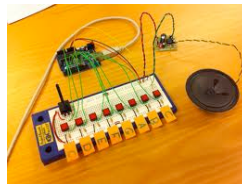
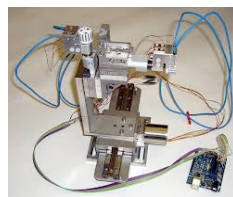
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Introduction till Arduino

ANDERS J JOHANSSON



Project using an Arduino



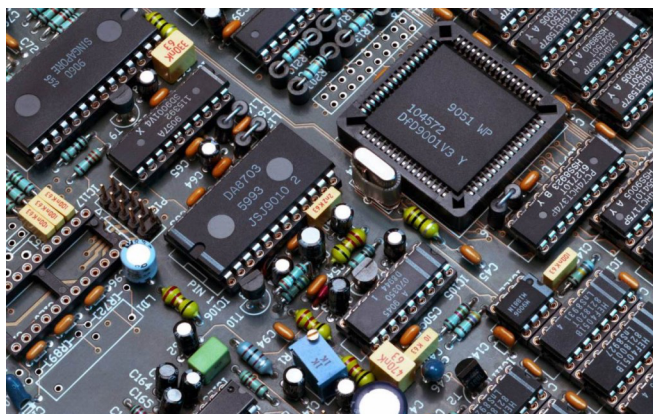
Wearable Electronics



Flora, Lilypad, Gemma

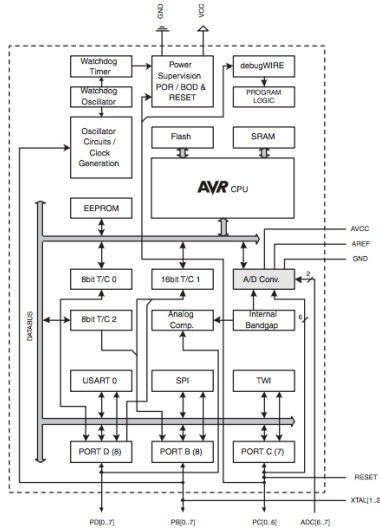


Microcontroller - Embedded systems

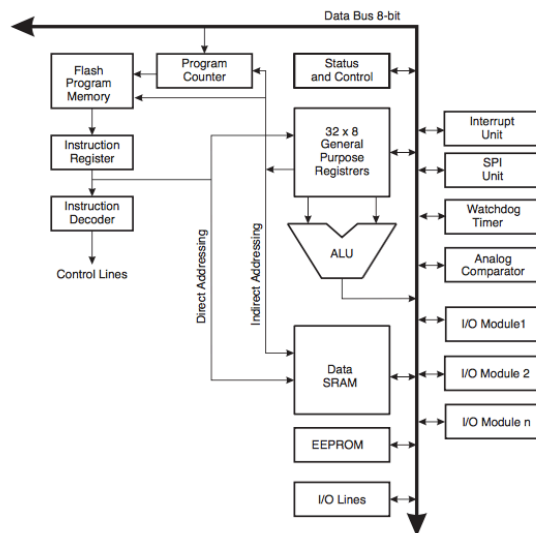


Inside the microcontroller

Block Diagram

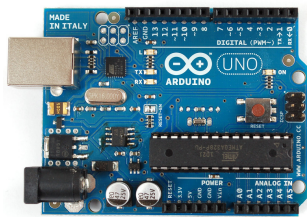


Inside the CPU

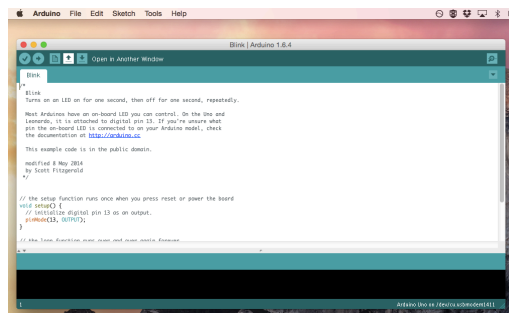


Arduino

Hardware



Software + IDE
(Integrated Development Environment)



Processing



- Cover
- Download
- Exhibition
- Reference Libraries
- Tools
- Environment
- Tutorials
- Examples
- Books
- Handbook



Welcome to Processing 3! Dan explains the new features and changes; the links Dan mentions are on the [Vimeo page](#).

>> Exhibition



Stewart - A mutually trustful interface for a fully autonomous car by Felix Ros



Open source

Mjukvara

Java-environment

- GPL 


C/C++ bibliotek

- LGPL 

Hårdvara

- Kretsscheman
- CAD-filer (Eagle-cad)

Creative Commons Licens

- Share alike
- Attribution 

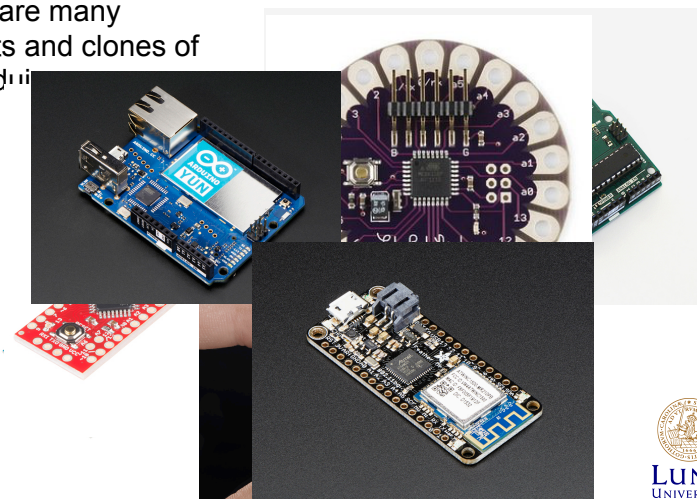


Arduino.cc

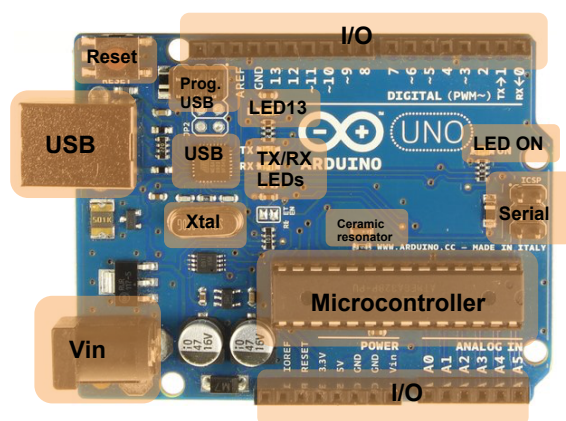


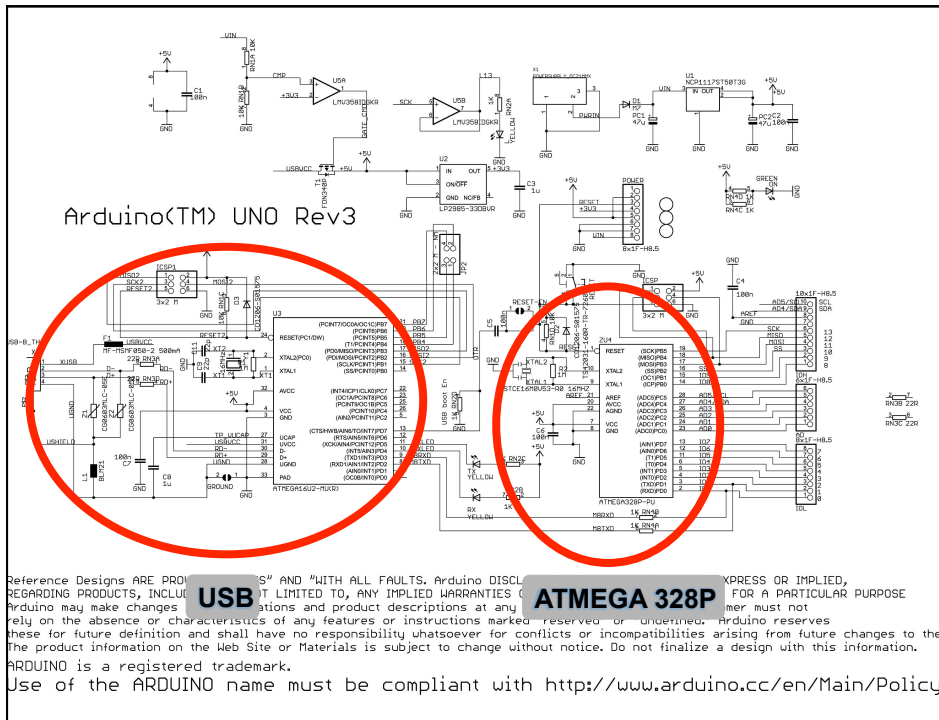
Arduino hardware

There are many variants and clones of the Arduino



Arduino UNO





Programming - SARA

- Sequence
- Alternative
- Repetition
- Abstraction



Arduino: the language

Structure

setup()

loop()

Digital I/O

pinMode()

digitalWrite()

digitalRead()

Analog I/O

analogReference()

analogRead()

analogWrite()

Control Structures

if

if...else

for

switch case

while

do... while

break

continue

return

goto



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Variables

Data Types

void (0)

boolean (1B)

char (1B)

unsigned char (1B)

byte (1B)

int (2B)

unsigned int (2B)

word (2B)

long (4B)

unsigned long (4B)

short (2B)

float (4B)

double (4B)

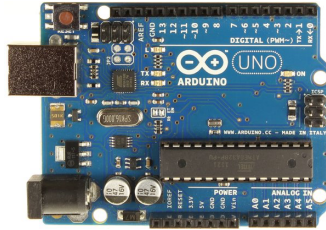
string - char array

String = object array



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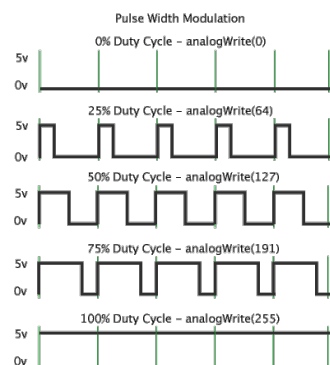
I/O ports



- 6 Analog inputs
- 14 digital I/O
 - 6 st with PWM output (3,5,6,9,10,11)
- Buss-support
 - I2C/TWI (A4, A5)
 - SPI (10,11,12,13)
 - TTL serial (USB och 0,1)
- External interrupts (2,3)
- LED (13)



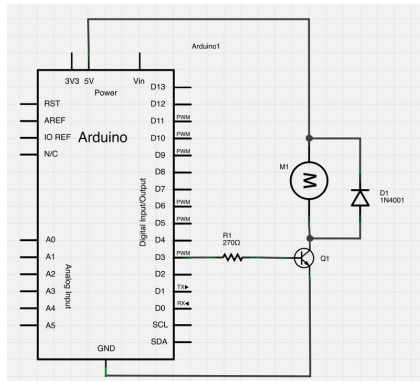
PWM



- Pulse Width Modulation
- Needs a filter to give a constant signal, such as
 - Low-pass filter (R-C)
 - The eye
 - Momentum in a spinning motor



Motorer



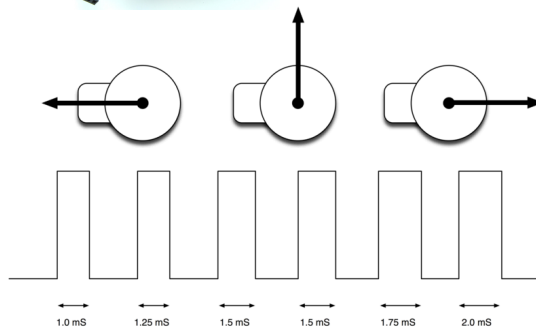
- Use PWM
- Add a diode to protect the Arduino
- Use a transistor to control the current ($I_{max} = 20\text{mA}$)



Servo electrical interface



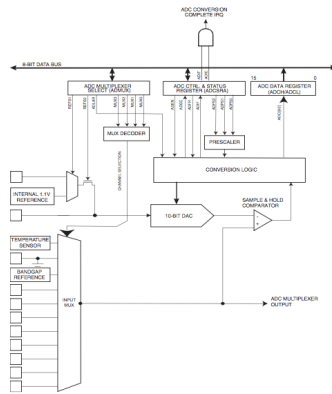
- 1-2 ms pulse width
- 50 Hz pulse frequency
- 1.5 ms is middle



Adafruit.com



10-bit successive approximation ADC

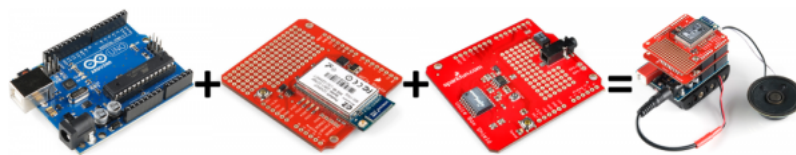


Features

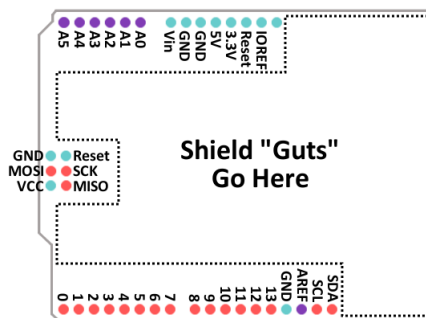
- 10-bit Resolution
- 0.5 LSB Integral Non-linearity
- ± 2 LSB Absolute Accuracy
- 13 - 260 μ s Conversion Time
- Up to 76.9kSPS (Up to 15kSPS at Maximum Resolution)



Shields



- "shields" är add-ons to the Arduino.
- Are using the contacts along the edge
- Exists in hundreds of variants

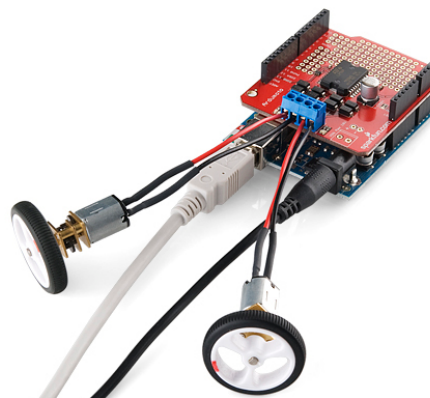


Shields

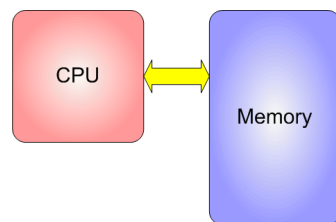


Motorstyrning

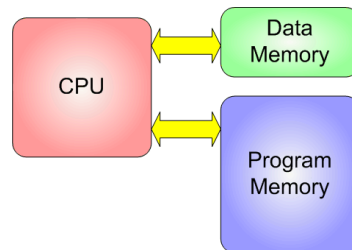
- Finns i flera olika varianter
 - Likströmsmotorer
 - Servon
 - Stegmotorer
- Välj efter
 - Antal motorer
 - Storlek på motorer
 - Typ av motorer
- Extern spänning till motorena?



Von Neumann vs. Harvard arkitektur



Von Neumann
Ett minne för både
program och data.

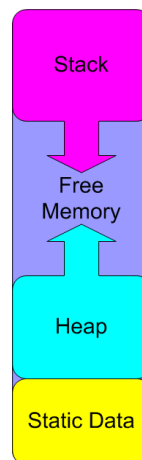


Harvard
Skilda minnen för
program och data.



Minnen i Arduino

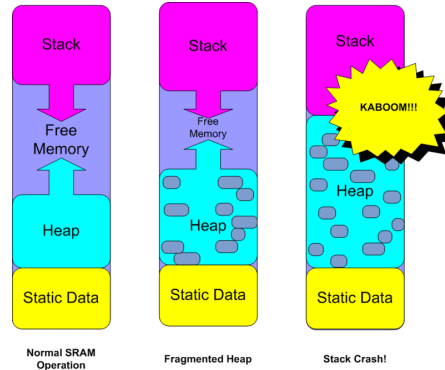
- Flash för program
 - >10k skrivcykler (write/erase)
- SRAM för data
 - Statisk data
 - Heap
 - Stack
- EEPROM för annan datalagring
 - >100k skrivcykler (write/erase)
- SRAM memory map



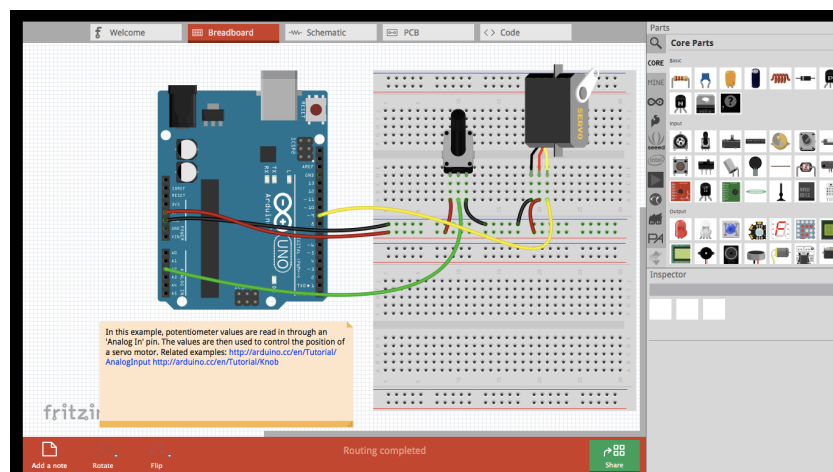
Användning av Heap och Stack

Följande använder mycket minne :

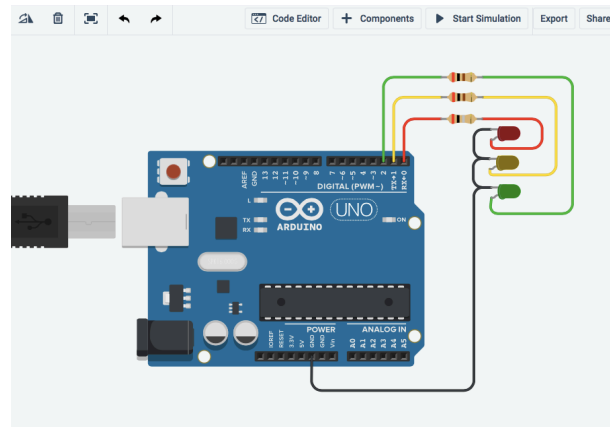
- SD-kort
- Flerfärgade lysdioder
- Displayer
- Globala variabler (static data, heap)



Fritzing



Arduino simulator: Tinkercad.com



Raspberry Pi



Simple, cheap Linux-computer. (159:- , 329:- , 499:-)

More powerful, and more complicated, than the Arduino.

Often programmed in Python.

HDMI-output, USB-connectivity, TCP/IP.

Possible to attach electronics in the same way as to an Arduino.



Webbadresser

Main one:

- arduino.cc

Where to find parts

- Google.com
- adafruit.com
- sparkfun.com

Webb-education

- learn.adafruit.com
- learn.sparkfun.com

Swedish retailers

- electrokit.se
- lawicel.se
- elfa.se
- farnell.se

Development

- processing.org
- fritzing.org
- tinkercad.com



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