Introduction to Arduino
A hands on Workshop

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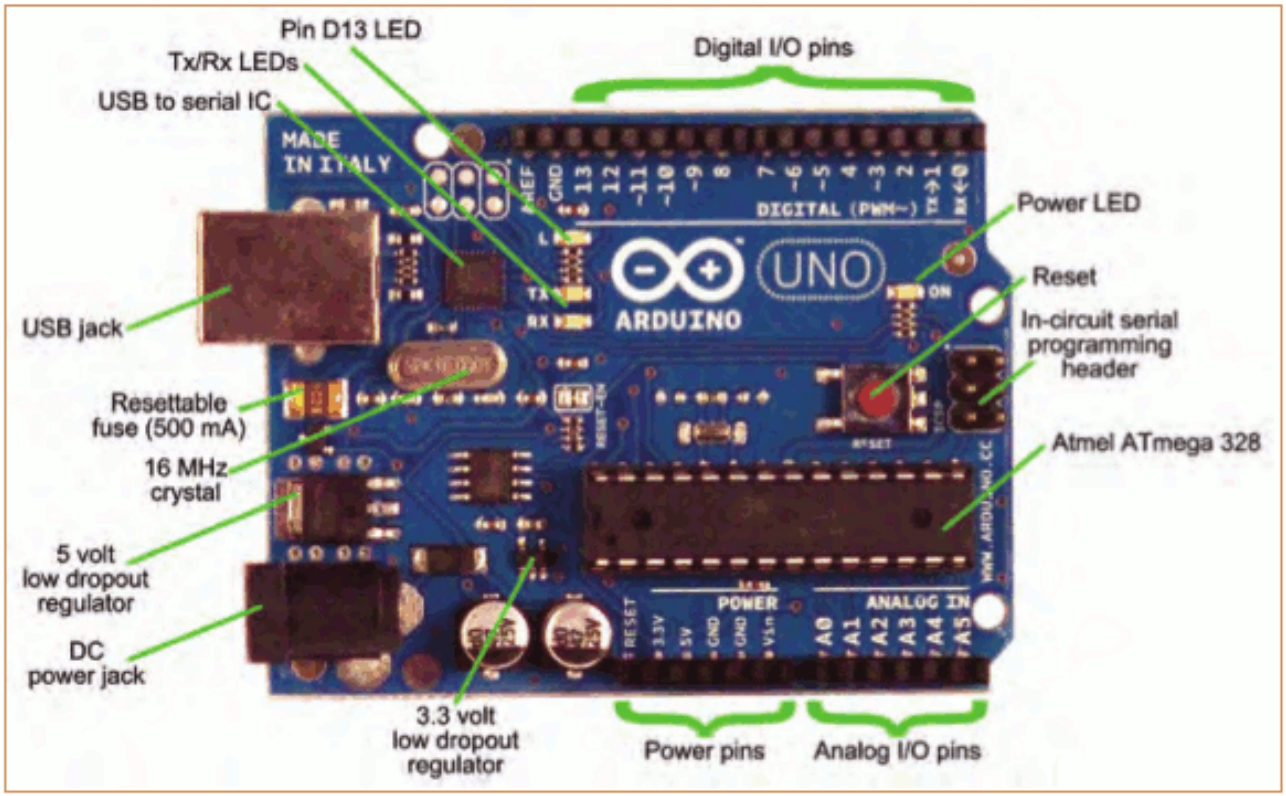
Overview of Arduino Platform

- Software Support
  - Windows
  - Linux
  - Mac
- Hardware Variants
  - Arduino Uno
  - Arduino Mega
  - Arduino Mini
  - Many more

Let us meet Arduino Uno



Getting started

Get hardware

Get hold of an arduino from amazon, ebay or a local vendor

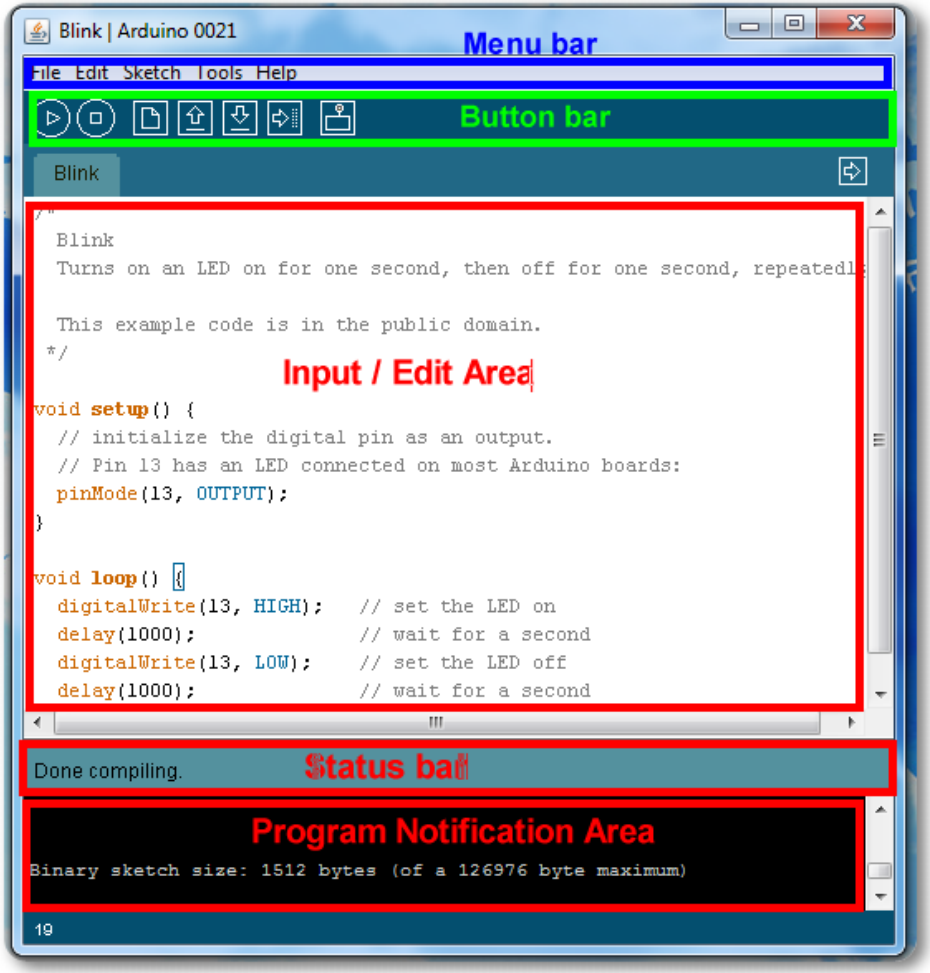
Download software

Check out: http://arduino.cc/en/Guide/HomePage

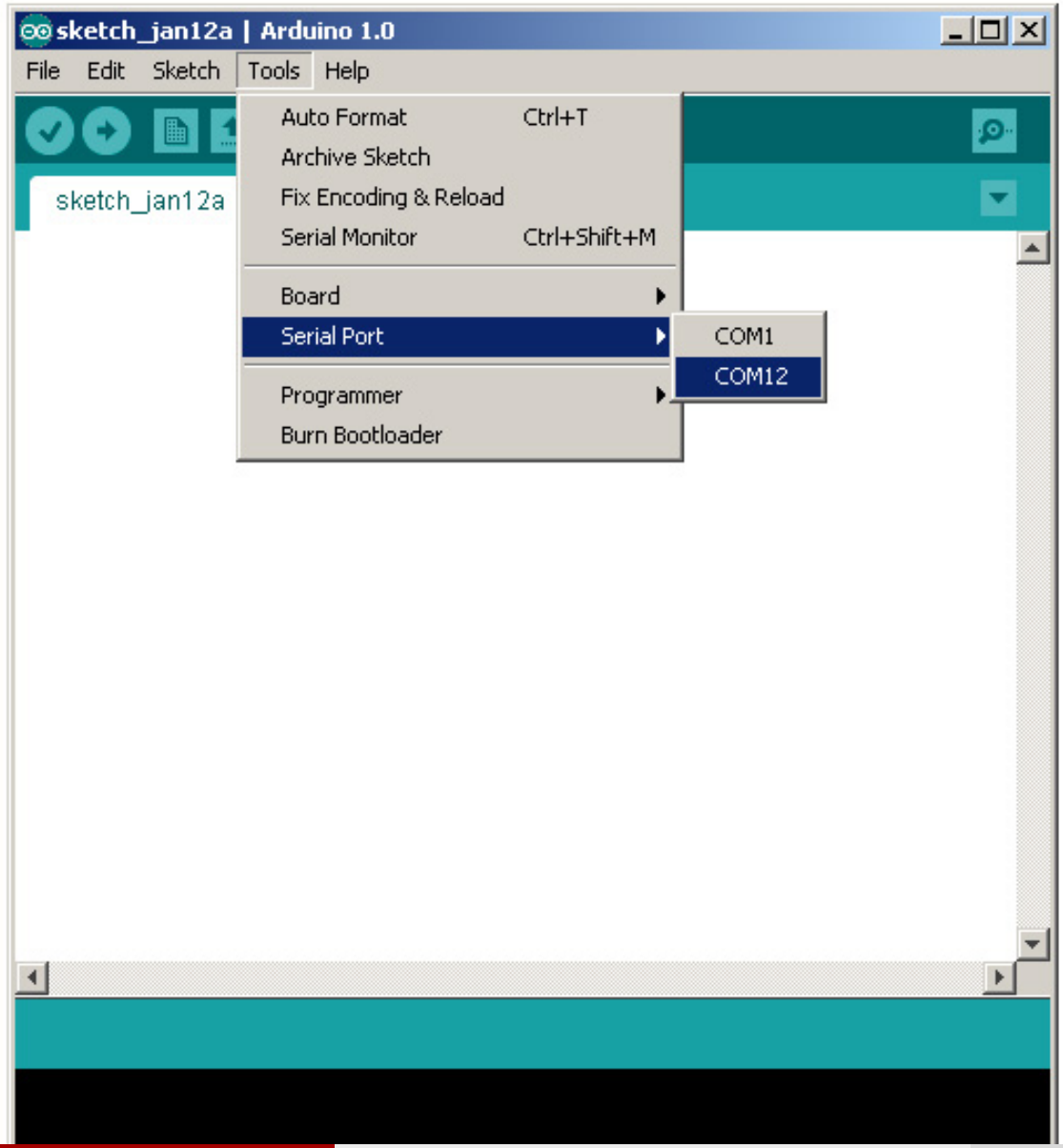
Play

Download & install the Arduino environment (IDE) (not needed in Linux)
Connect the board to your computer via the USB cable
Launch the Arduino IDE
Select your board
Select your serial port
Open the blink example

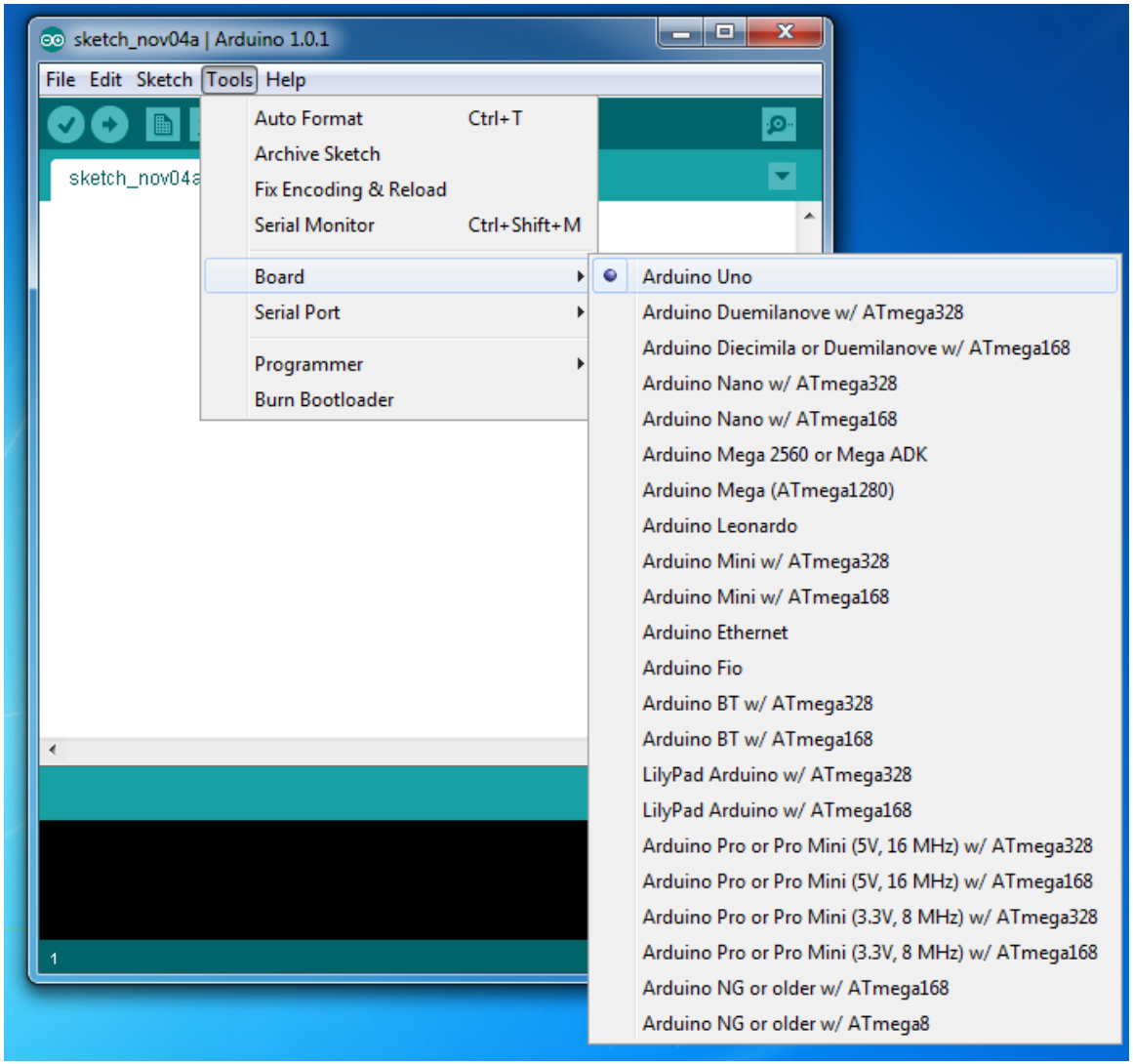
Arduino IDE


Blink | Arduino 0021
Menu bar
File Edit Sketch Tools Help
Button bar
Blink
Blink
Turns on an LED on for one second, then off for one second, repeatedly.
This example code is in the public domain.
Input / Edit Area
void setup() {
// initialize the digital pin as an output.
// Pin 13 has an LED connected on most Arduino boards:
pinMode(13, OUTPUT);
}
void loop() {
digitalWrite(13, HIGH); // set the LED on
delay(1000); // wait for a second
digitalWrite(13, LOW); // set the LED off
delay(1000); // wait for a second
Done compiling.
Status bar
Program Notification Area
Binary sketch size: 1512 bytes (of a 126976 byte maximum)
19

Selecting Serial Port

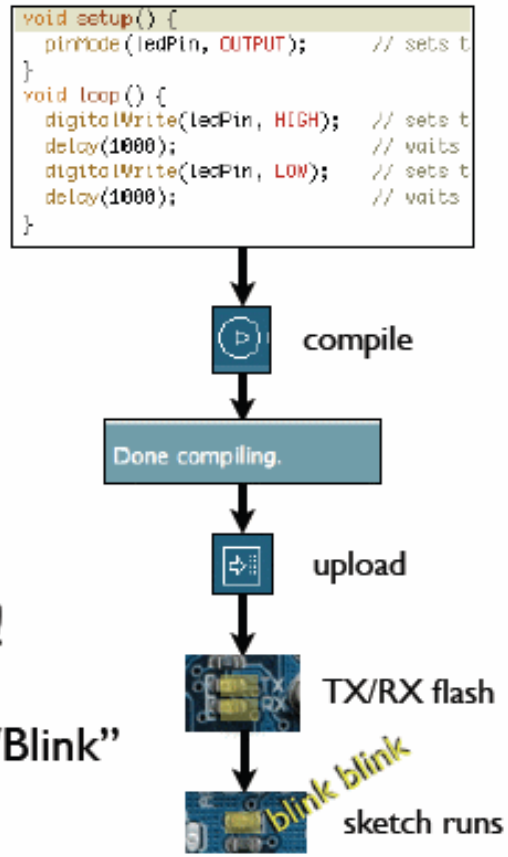


Selecting Board



Using Arduino

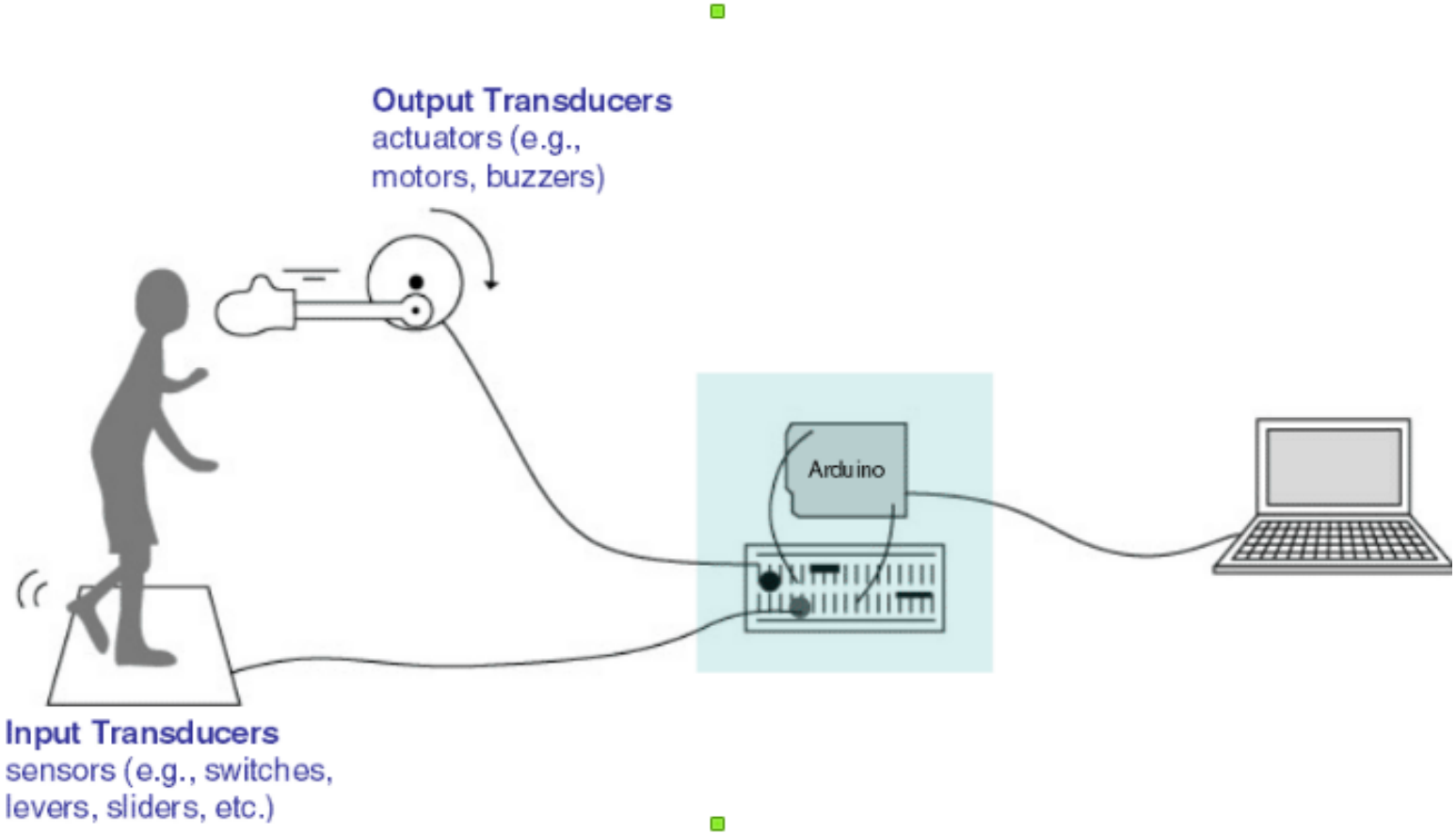
- Write your sketch
- Press Compile button (to check for errors)
- Press Upload button to program Arduino board with your sketch



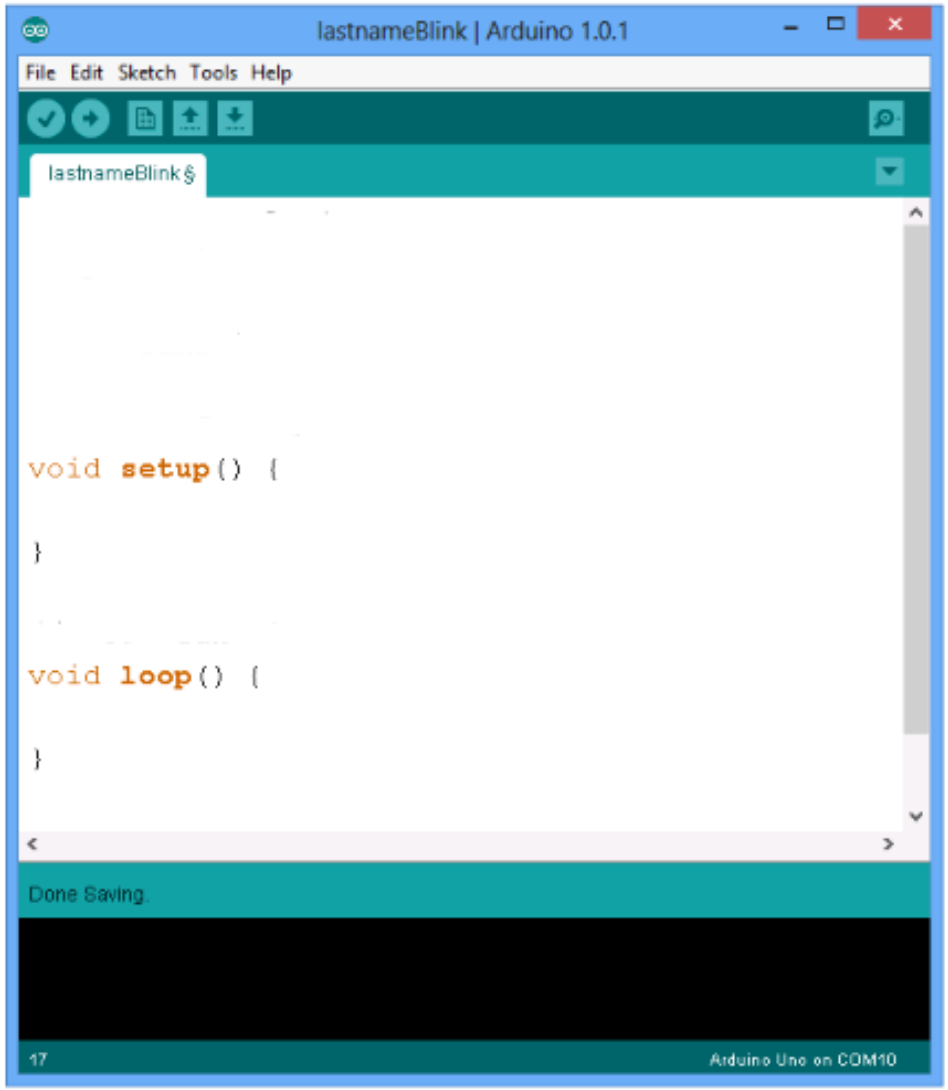
Try it out with the "Blink" sketch!

Load "File/Sketchbook/Examples/Digital/Blink"

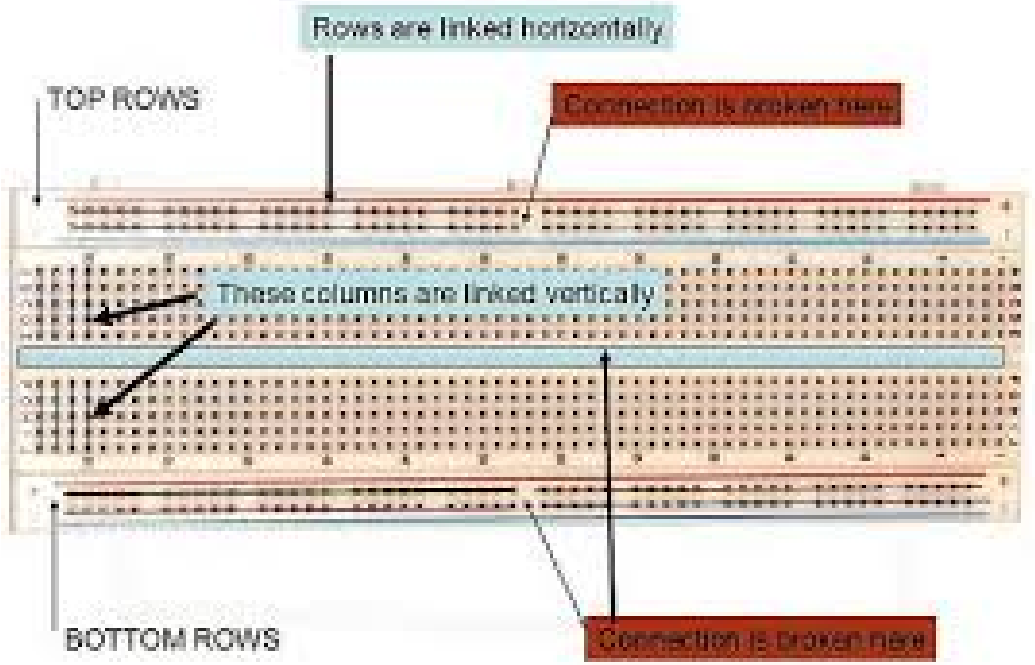
What you can do with arduino



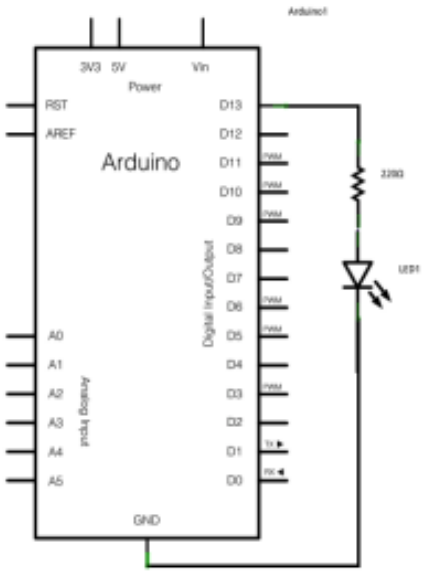
Structure of typical sketch

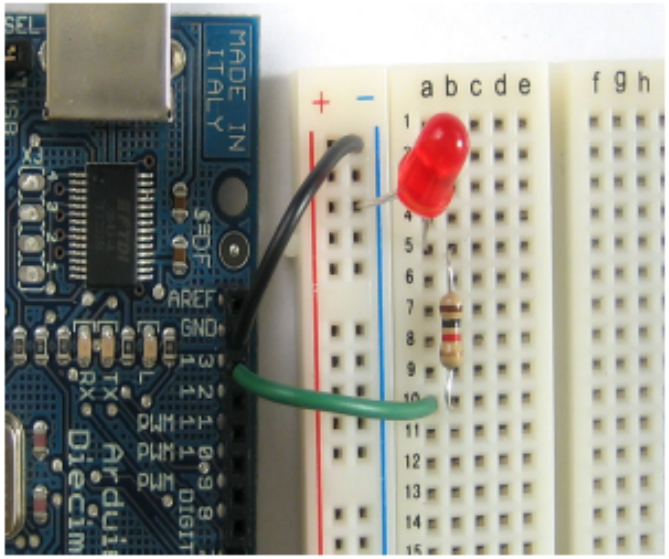


Know your prototyping board



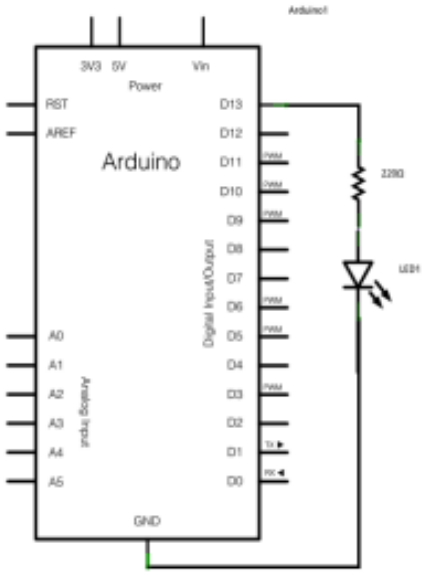
Let us turn on an LED

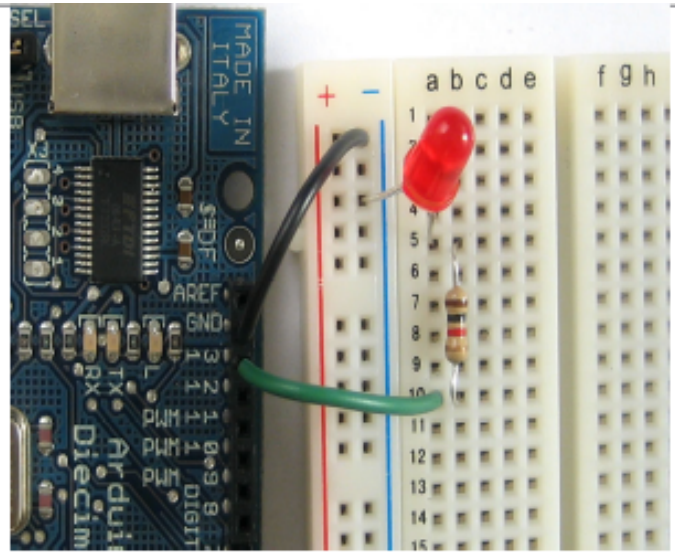





```
void setup()
{
  pinMode(13, OUTPUT);
  digitalWrite(13, HIGH);
}

void loop()
{

}
```

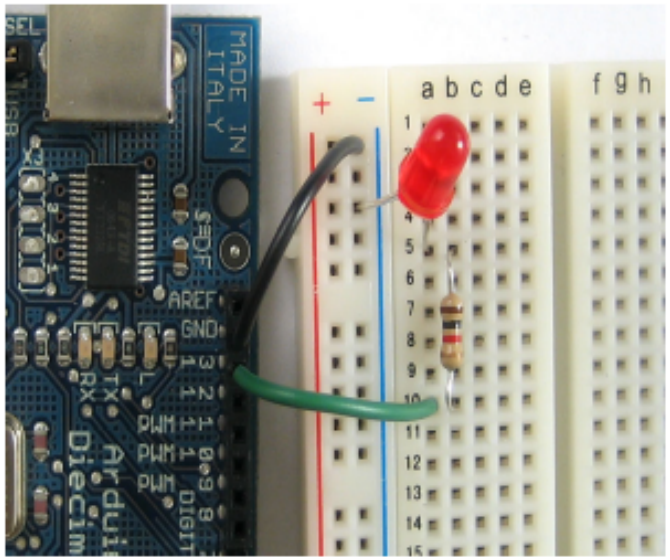
Now turn it off

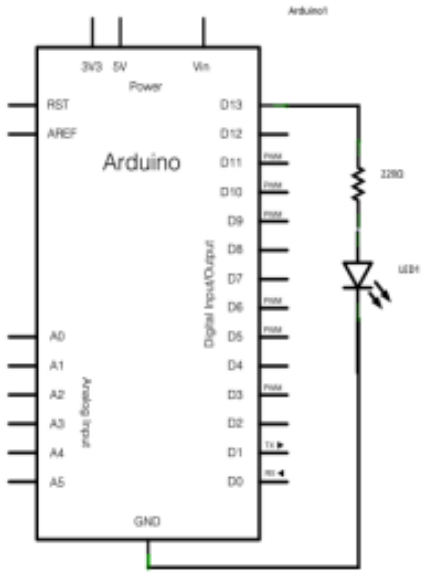





```
void setup()
{
  pinMode(13, OUTPUT);
  digitalWrite(13, LOW);
}

void loop()
{

}
```

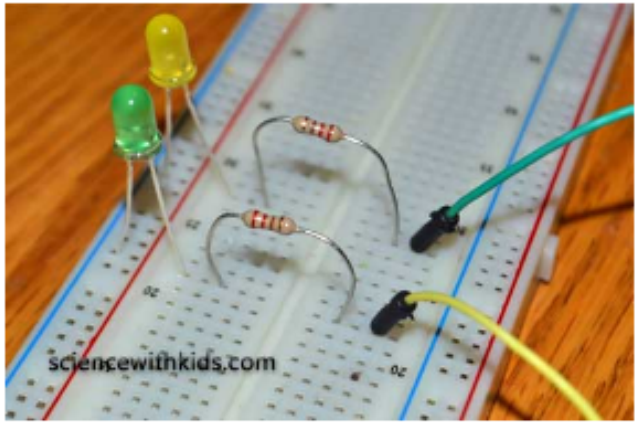
Blink






```
void setup()
{
  pinMode(13, OUTPUT);
}

void loop()
{
  digitalWrite(13, HIGH);
  delay(1000);
  digitalWrite(13, LOW);
  delay(1000);
}
```

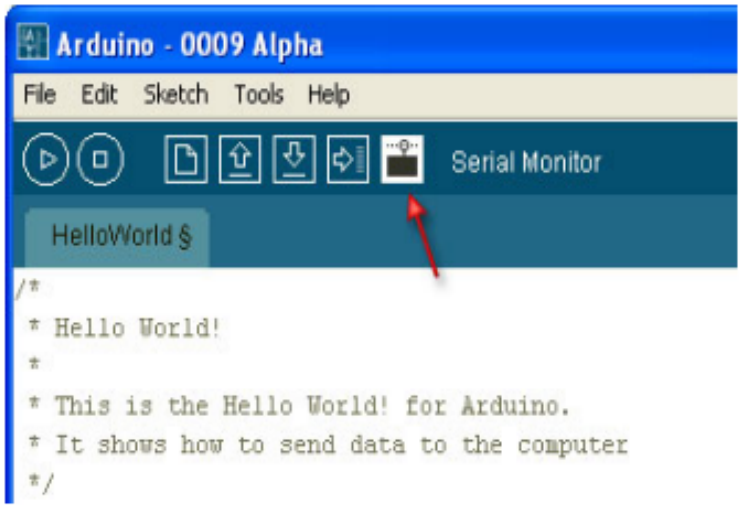
Project 1 -Build a dancing light

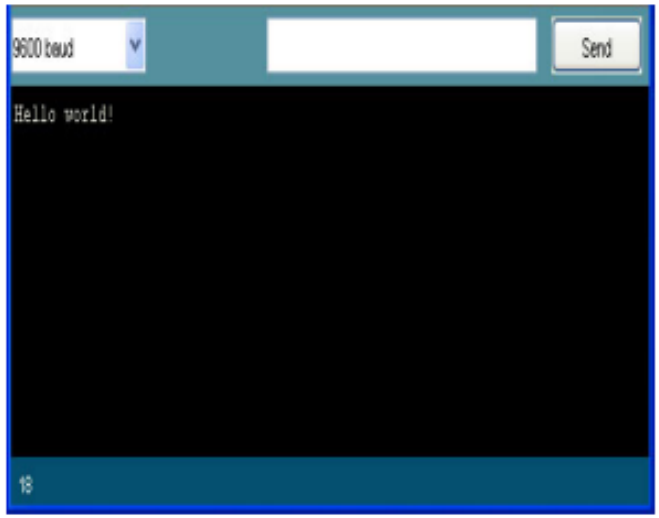



```
void setup()
{
  pinMode(10, OUTPUT);
  pinMode(11, OUTPUT);
}

void loop()
{
  digitalWrite(10, HIGH);
  digitalWrite(11, HIGH);
  delay(1000);
  digitalWrite(10, LOW);
  digitalWrite(11, LOW);
  delay(1000);
}
```

Serial Monitor

```
void setup()
{
  Serial.begin(9600);

  Serial.println("Hello world!");
}

void loop()
{

}
```

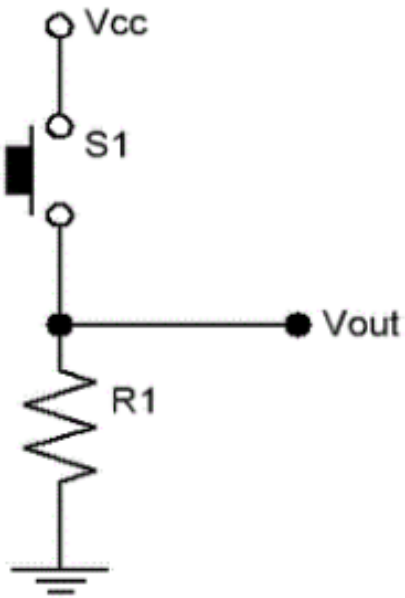




Serial Monitor

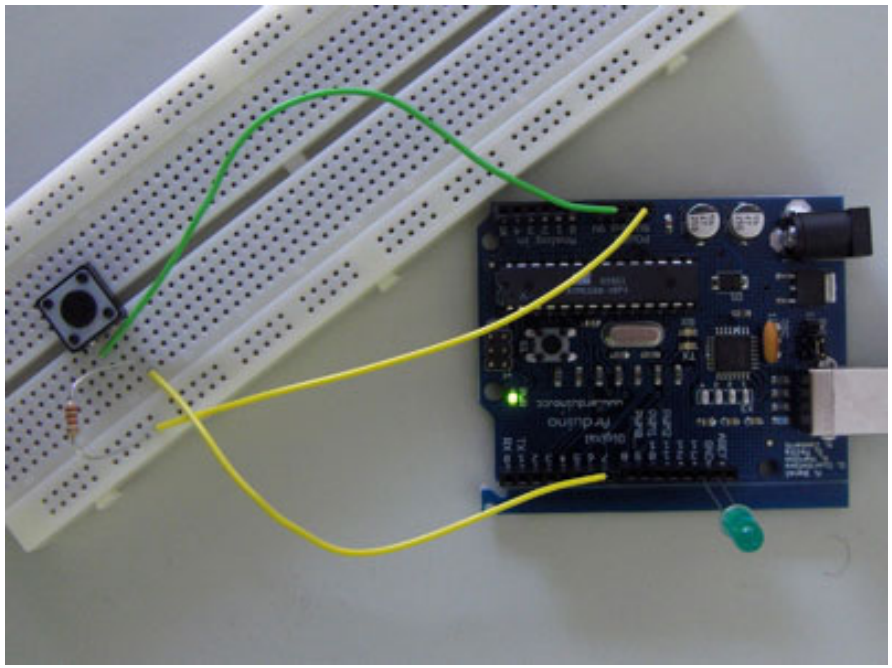
```
void setup()
{
  Serial.begin(9600);     // set up Serial library at 9600 bps
}

void loop()
{
  Serial.println("Hello world!"); // prints hello with ending line break
  delay(1000);
}
```

Reading switch

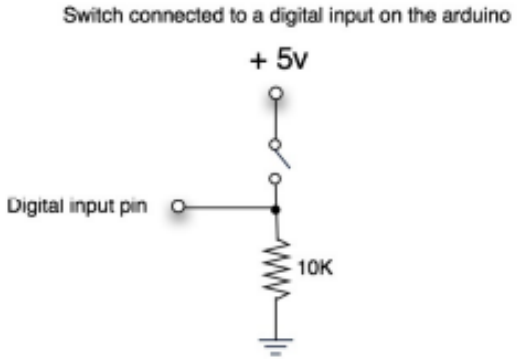


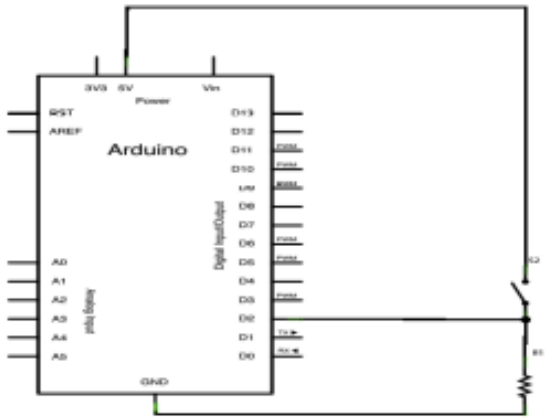
Pull Down

Reading switch



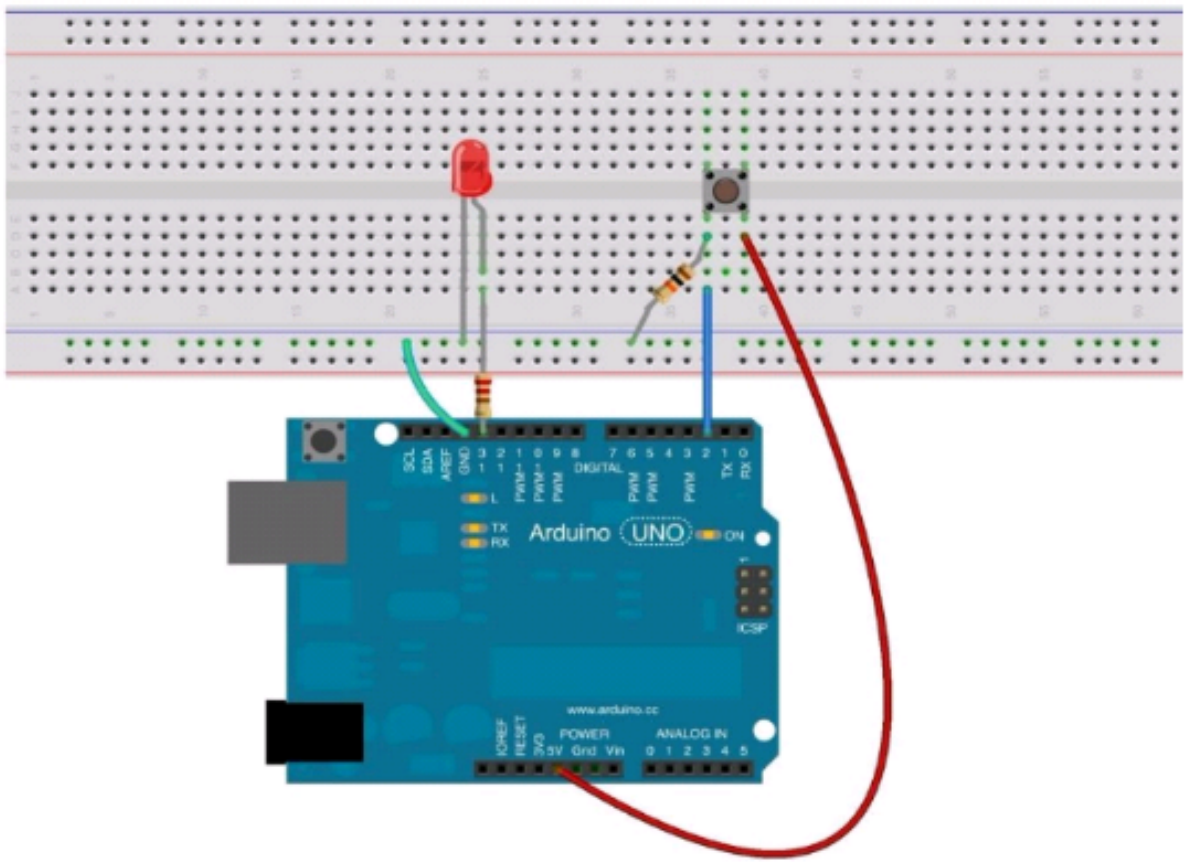
Reading switch



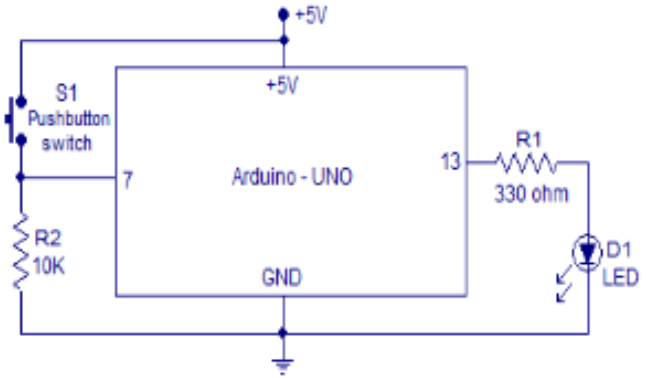



```
void setup()
{
  Serial.begin(9600);
  pinMode(2, INPUT);
}

void loop()
{
  Serial.print("Read switch input: ");
  Serial.println(digitalRead(2));
  delay(100);
}
```

Switch with LED



Switch with LED



Push button controlled LED

```
int val;

void setup() {
  pinMode(12, OUTPUT);
  pinMode(2, INPUT);
}

void loop(){
  val = digitalRead(2);
  if (val == LOW) {
    digitalWrite(12, LOW);
  }
  if (val == HIGH) {
    digitalWrite(12, HIGH);
  }
}
```

Digital IO vs Analog IO

I/O Pins

Digital I/O

Standard 1/0 levels

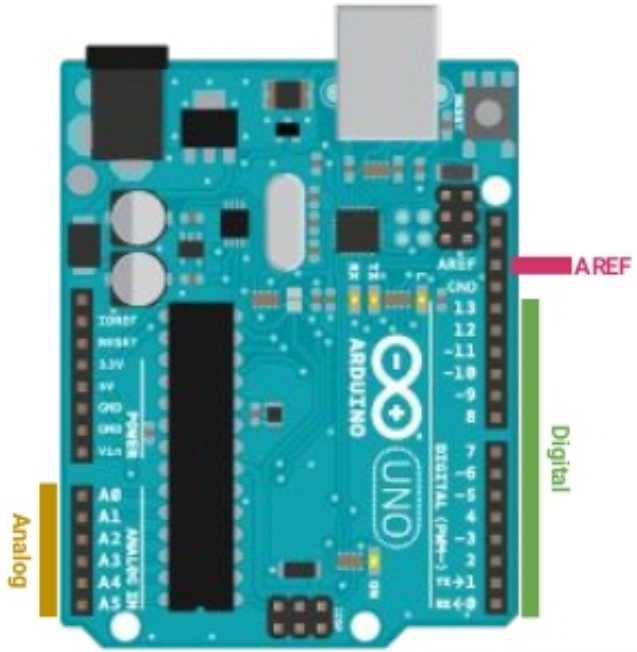
5 volts

Analog Input

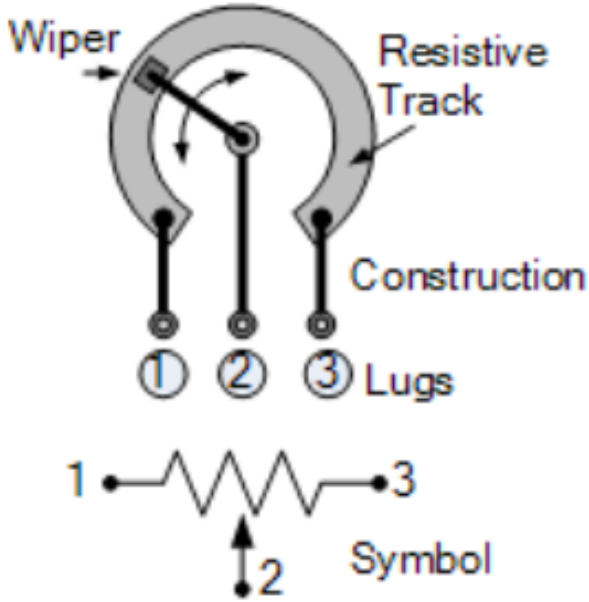
10-bit ADC

0-5 volts adjusted via AREF

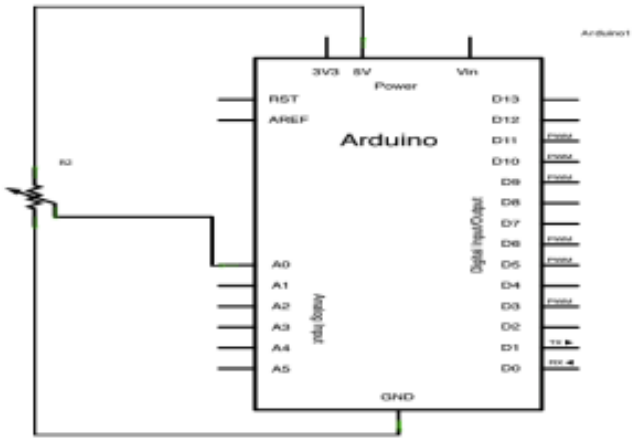
Can be used as Digital I/O



Know your potentiometer



Analog Read

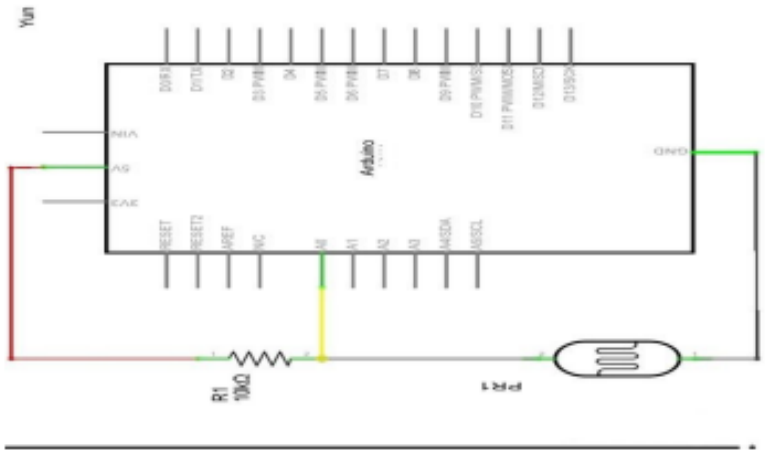



```
void setup()
 {
 Serial.begin(9600);
}
void loop() {
 int sensorValue = analogRead(A0);
 Serial.println(sensorValue);
 delay(10);      }
```

Analog Read

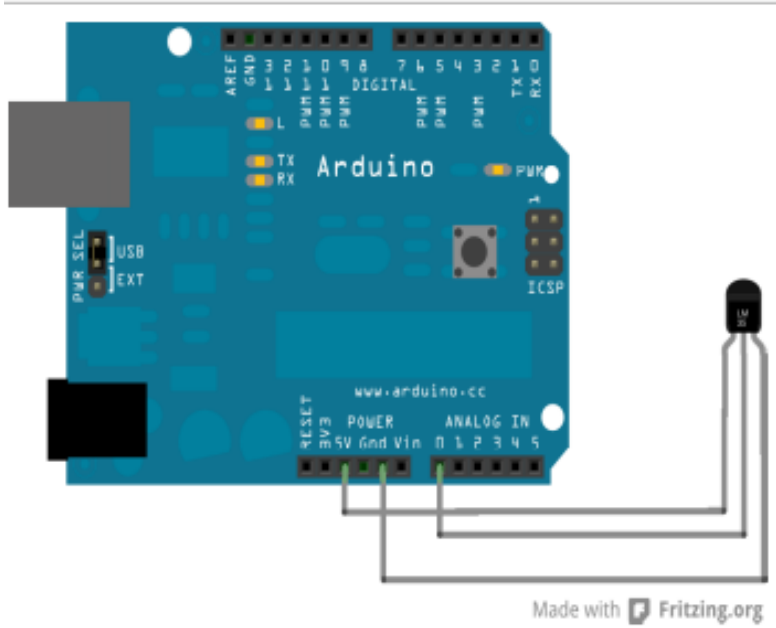
```
void setup() {


  Serial.begin(9600);

}
void loop() {
   int sensorValue = analogRead(A0);


  float voltage = sensorValue * (5.0 / 1023.0);


  Serial.println(voltage);

  delay(100);

}
```

Project 2 - Reading Light intensity




```
void setup()
{
  Serial.begin(9600);
}
void loop() {

  int lightLevel = analogRead(A0);

  float lux = lightLevel * (5.0 / 1024.0);

  Serial.println(lux);
}
```

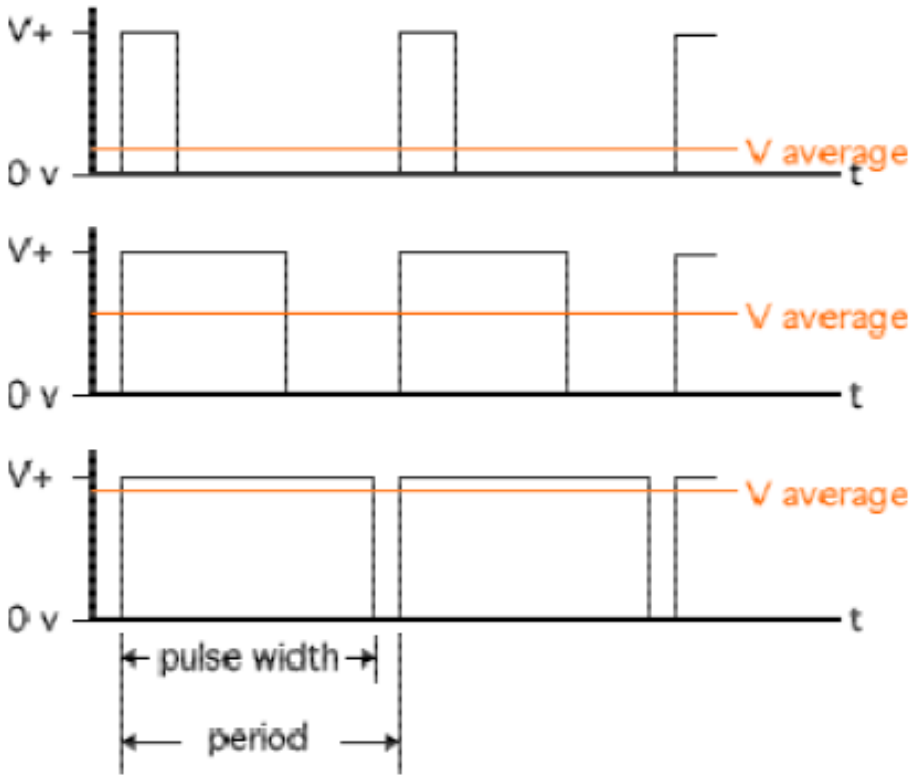
Project 3 - Thermometer



Temperature Measurement Using LM35

```
int val;

void setup()
{
Serial.begin(9600);
}
void loop()
{
val = analogRead(A0);
float mv = ( val/1024.0)*5000;
float cel = mv/10;
//float farh = (cel*9)/5 + 32;

Serial.print("TEMPRATURE =
");
Serial.print(cel);
Serial.print("*C");
Serial.println();
delay(1000);
}
```

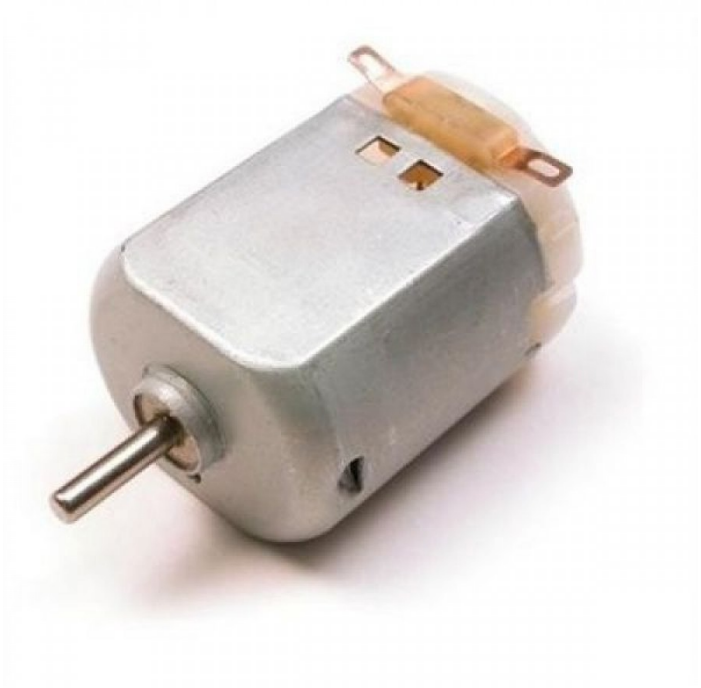
PWM

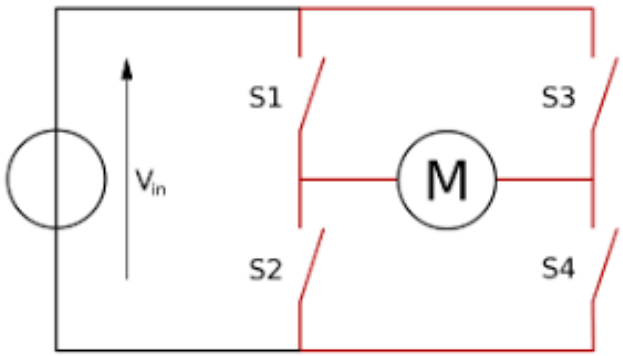

V+
0 v
V average
t
V+
0 v
V average
t
V+
0 v
V average
t
pulse width
period

PWM-Example: Fading light

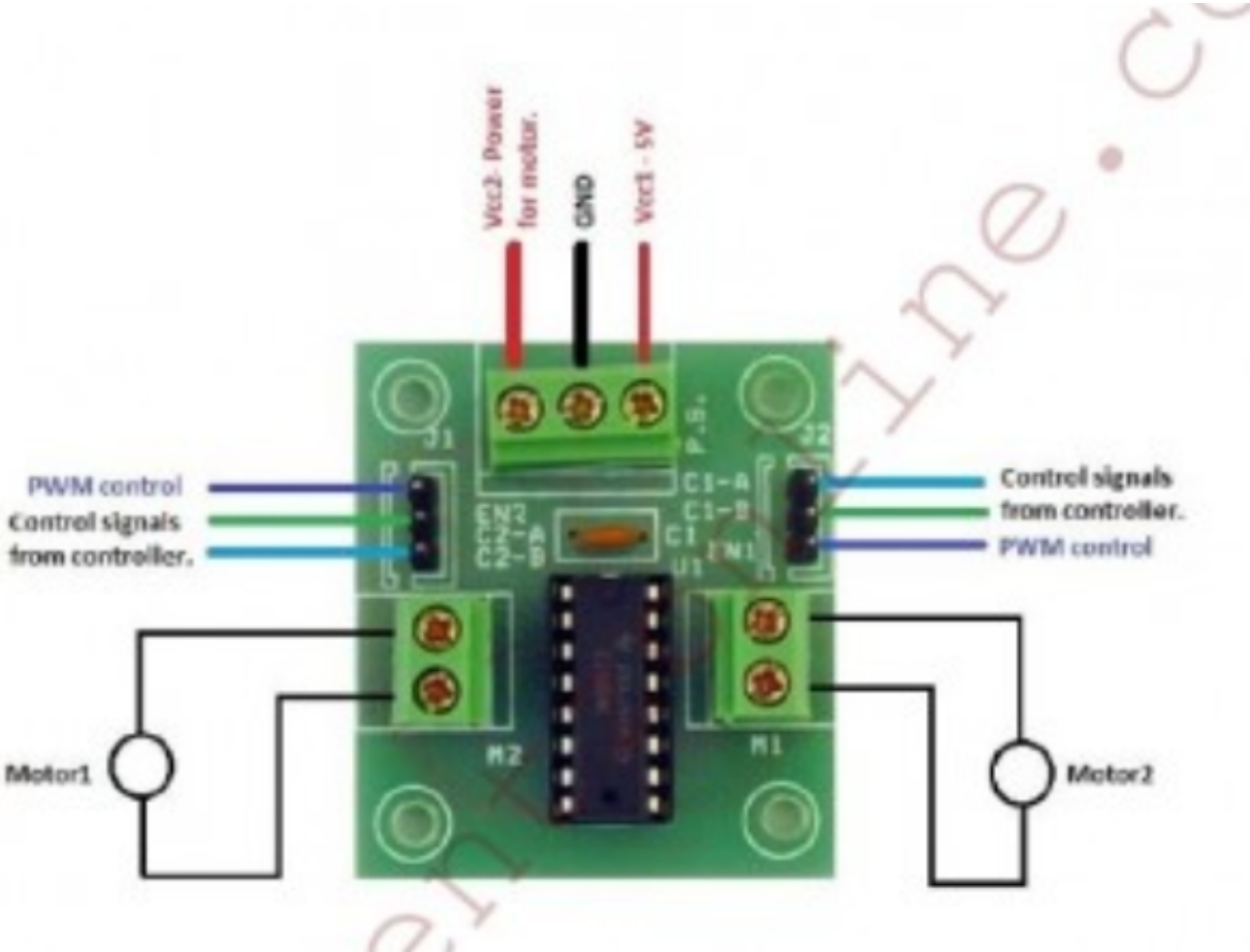
```
int led = 9;           // the pin that the LED is attached to
int brightness = 0;    // how bright the LED is
int fadeAmount = 5;    // how many points to fade the LED by

// the setup routine runs once when you press reset:
void setup()  {
  // declare pin 9 to be an output:
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop()  {
  // set the brightness of pin 9:
  analogWrite(led, brightness);

  // change the brightness for next time through the loop:
  brightness = brightness + fadeAmount;

  // reverse the direction of the fading at the ends of the fade:
  if (brightness == 0 || brightness == 255) {
    fadeAmount = -fadeAmount ;
  }
  // wait for 30 milliseconds to see the dimming effect
  delay(30);
}
```

DC motor and H bridge

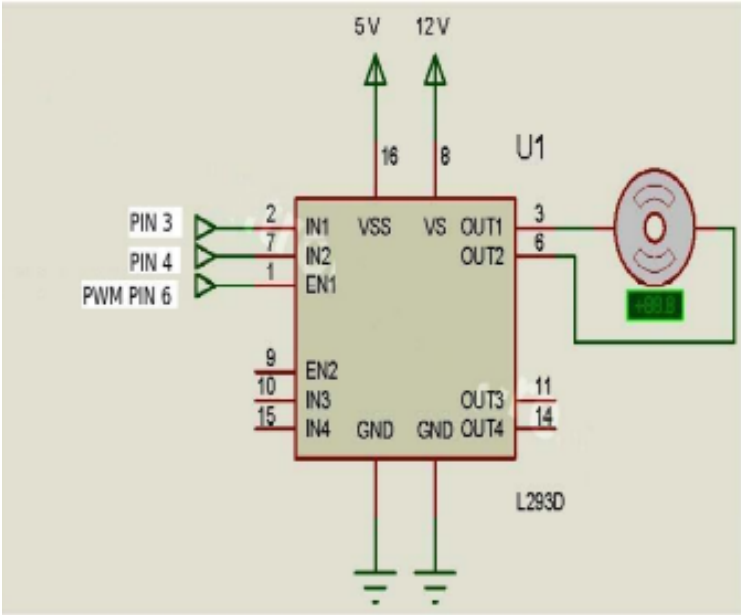




H-Bridge board



Motor Control



Interfacing DC Motor with Arduino

```
void setup() {


   pinMode(3, OUTPUT);
   pinMode(4, OUTPUT);
}

void loop() {


  digitalWrite(3, HIGH);
  digitalWrite(4, LOW);

    delay(5000);
    // stop
  digitalWrite(3, LOW);
   digitalWrite(4, LOW);
  // change direction
    delay(5000);
    digitalWrite(3, LOW);
    digitalWrite(4, HIGH);

    delay(5000);
}
```

The Road ahead

- Interfacing LCD displays
- Interfacing sensors like ultra sound PIR
- Ethernet and bluetooth

Other IOT platforms

- Raspberry PI
- ESP 8266

MQTT Protocol

- Installation
- Programming

Cloud and Big data

Thank you

You can reach me

On Facebook
http://facebook.com/vu2swx
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brainstorms.in
On Amateur Radio
VU2SWX