

Programming with arduino

Lesson 10/05/2017

Fifth Program

Temperature and humidity sensor

DHT11 Sensor

The DHT11 is a relatively cheap sensor for measuring temperature and humidity.

The DHT11 has three lines:

- GND,
- +5V
- and a single data line.

Signal transmission range: 20m

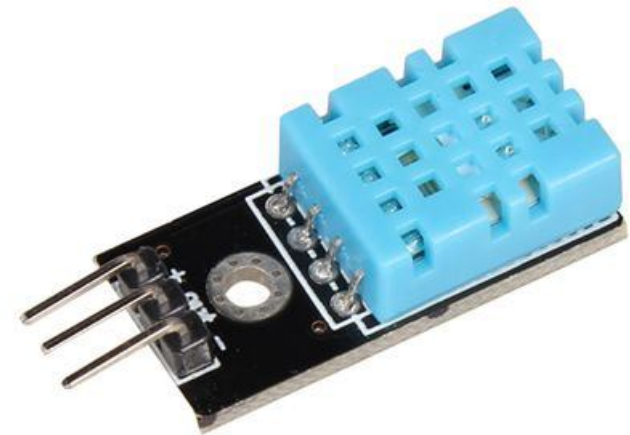
Temperature range: 0-50°C

Humidity range: 20-90%RH

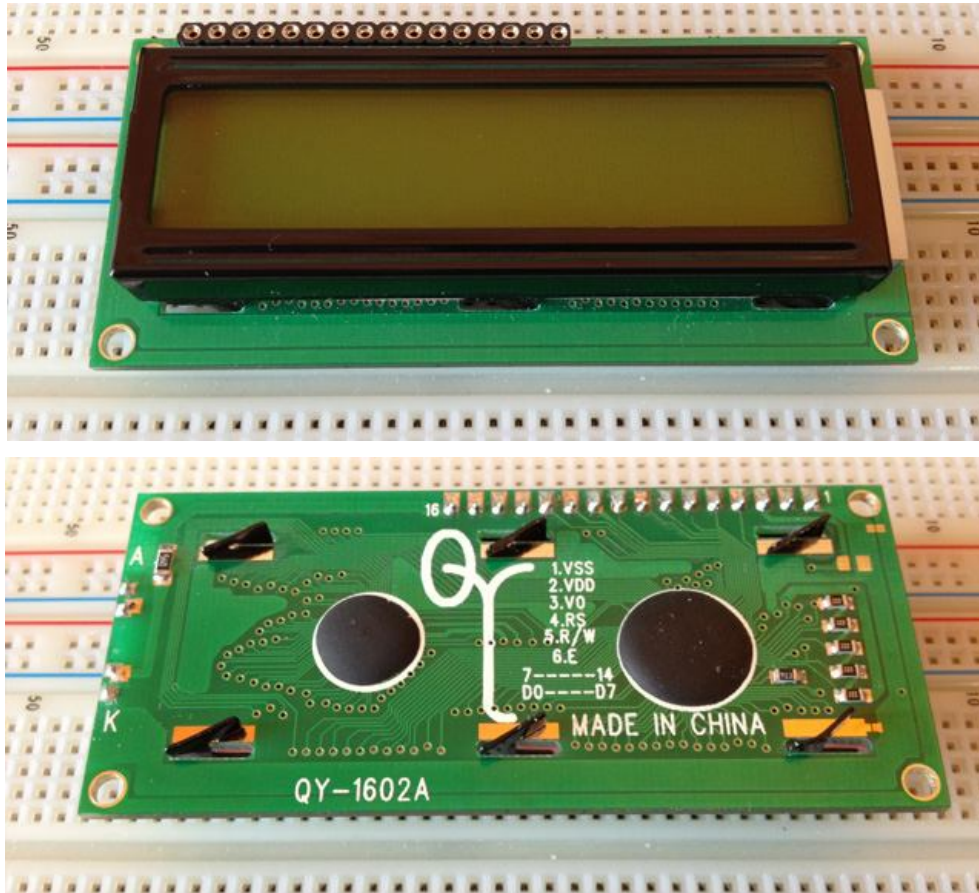
Datasheet:

<http://www.micro4you.com/files/sensor/DHT11.pdf>

L'esercitazione consiste nel leggere I valori di umidità e temperatura del sensore e visualizzarli su monitor LCD



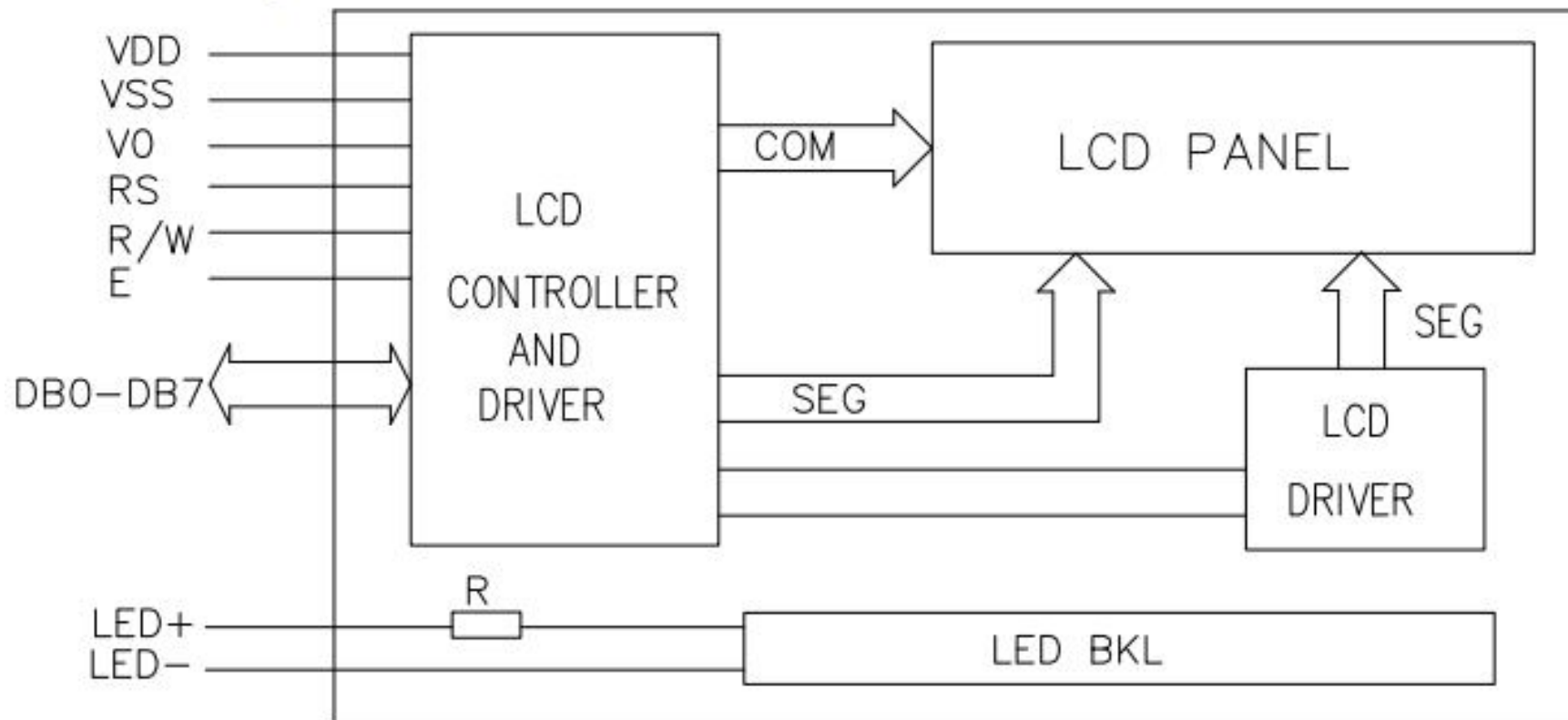
Monitor LCD



- Library: LiquidCrystal.h
- You can communicate with 4 bit (4 lines) or 8 bit (8 lines)
- Total lines: 4 or 8 + 2 controller lines:
 - Register Select (RS)
 - Enable (E)
 - + 1 optional line Read/write (RW)

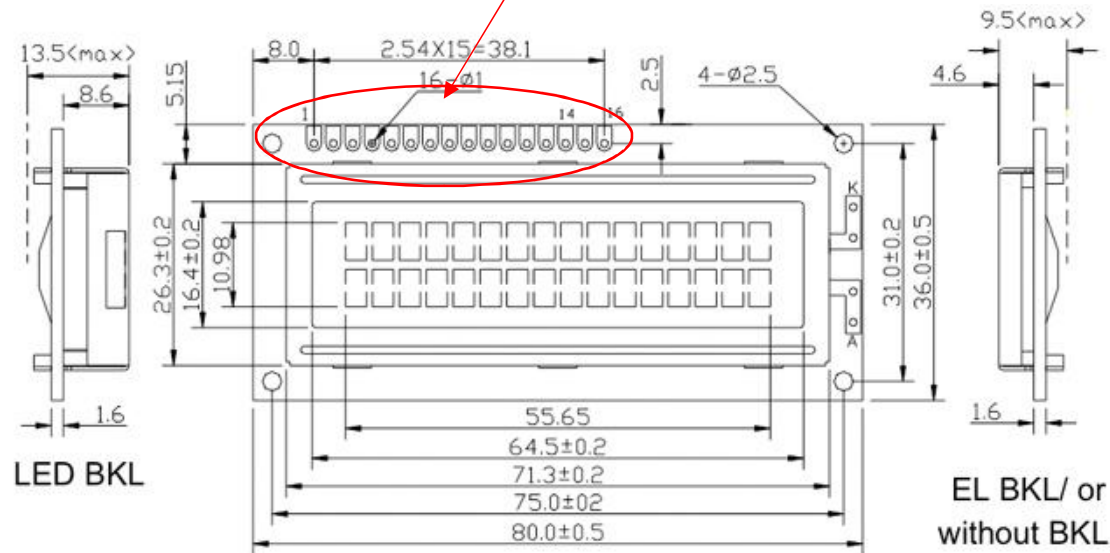
<https://www.sparkfun.com/datasheets/LCD/ADM1602K-NSW-FBS-3.3v.pdf>

Block Diagram



Pin description

16 Digital Pins



PIN NO	Symbol	Fuction
1	VSS	GND
2	VDD	+5V
3	V0	Contrast adjustment
4	RS	H/L Register select signal
5	R/W	H/L Read/Write signal
6	E	H/L Enable signal
7	DB0	H/L Data bus line
8	DB1	H/L Data bus line
9	DB2	H/L Data bus line
10	DB3	H/L Data bus line
11	DB4	H/L Data bus line
12	DB5	H/L Data bus line
13	DB6	H/L Data bus line
14	DB7	H/L Data bus line
15	A	+4.2V for LED
16	K	Power supply for BKL(0V)

Pin Function

- Pin 1: Vss – connected to the GND
- Pin 2: VDD – connected to +5V
- Pin 3: V0 – control of the letters contrast. It is general connected to a potentiometer (or trimmer). (in this way it is possible apply a changeable voltage between 0V and 5V . Changing the voltage the contrast changes as well. Pin 4: RS signal– to select the register where register what appear on the LCD
- **Pin 5: Read/Write signal** – to select functional mode: R/W
- **Pin 6: Enable (E) signal** – to enable writing to the registers
- From **Pin 7 to Pin 14: lines used to communicate with the registers:**
 - HIGH (H) value indicates a written value (WRITE) of the bit on the display register
 - LOW (L) indicates a read value (READ) from the register
- Pin 15: A (Anode) – Pin to which a positive voltage is applied (+5V) to have the backlight of the display.
- Pin 16: K (Cathode) – Pin to which a GND is applied to have the backlight of the display.

I2C Communication

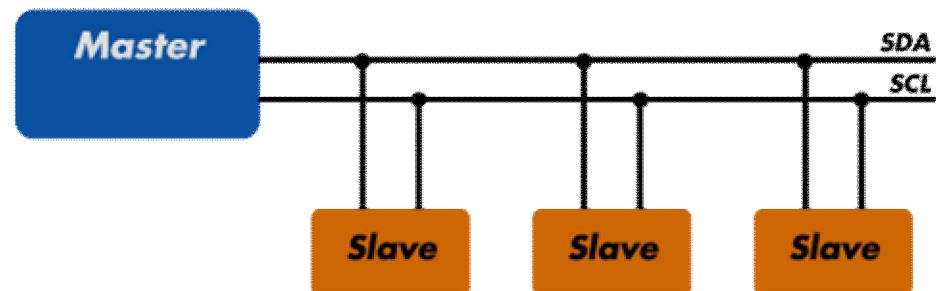
The I2C protocol involves using **two lines to send and receive data**:

- a **serial clock pin (SCL)** that the Arduino pulses at a regular interval,
- a **serial data pin (SDA)** over which *data is sent between the two devices*.

As the clock line changes from low to high (known as the rising edge of the clock pulse), a **single bit of information** - that *will form in sequence the address of a specific device and a command or data* - is transferred from the board to the I2C device over the SDA line.

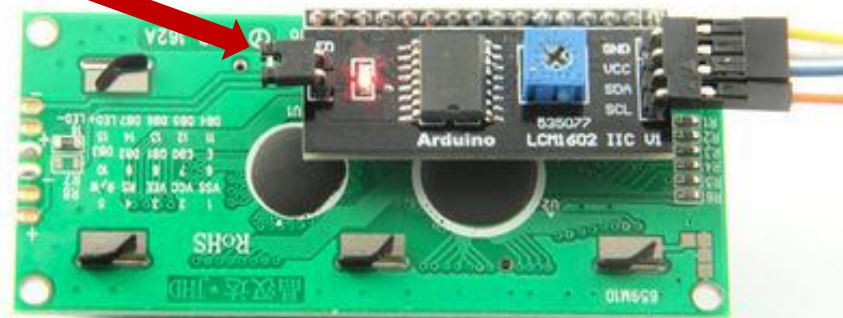
When this information is sent - bit after bit -, the called upon device executes the request and transmits it's data back - if required - to the board over the same line using the clock signal still generated by the Master on SCL as timing.

The *initial eight bits (i.e. eight clock pulses)* from the Master to Slaves contain the **address of the device** the Master wants data from. The bits after contain the **memory address on the Slave that the Master wants to read data from or write data to**, and the **data to be written** (if any).



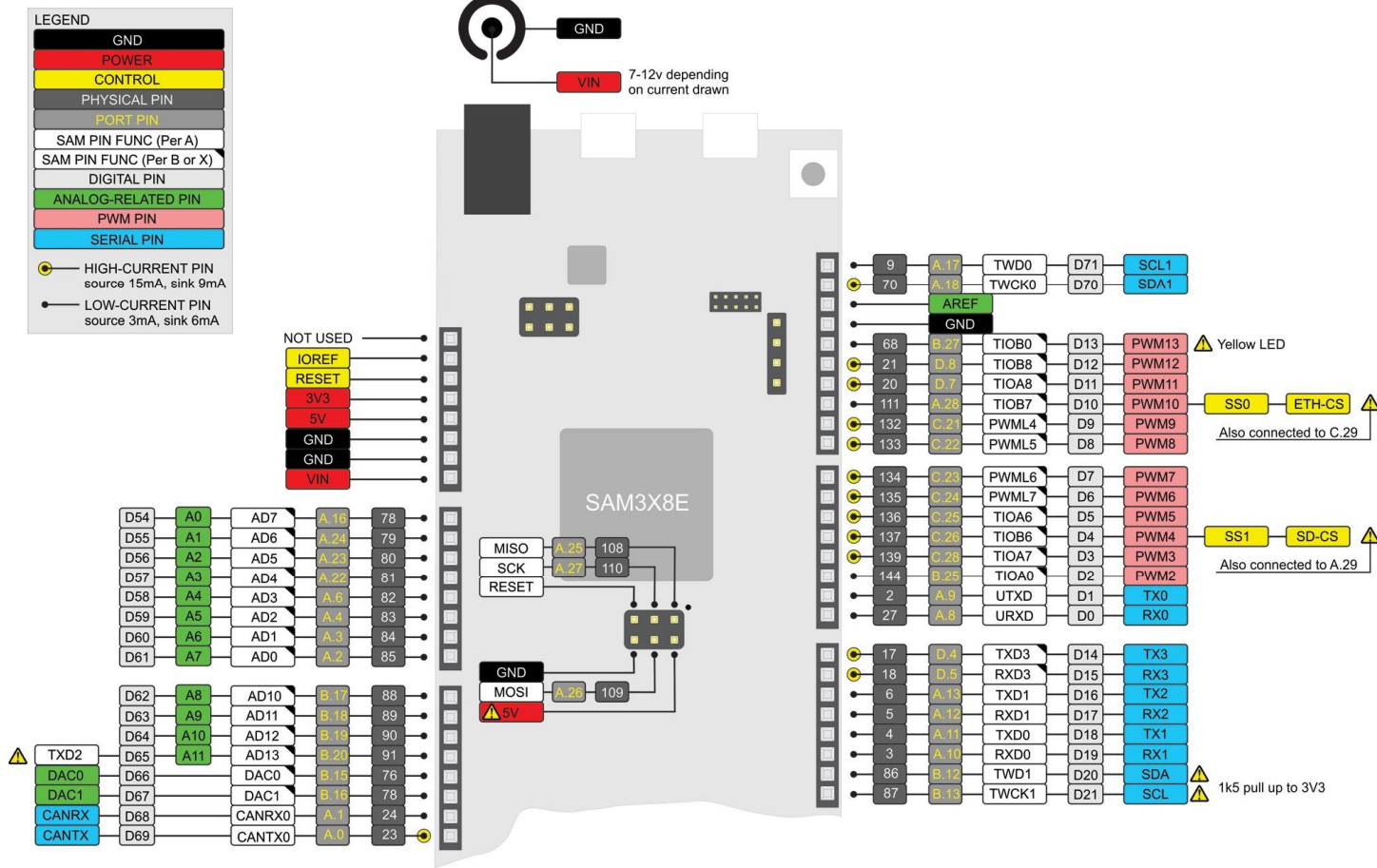
LCD monitor with I2C Driver

Jumper Blacklight



Board	I2C/TWI pins
Uno, Ethernet	A4 (SDA), A5 (SCL)
Mega2560	20 (SDA), 21 (SCL)
Leonardo	2 (SDA), 3 (SCL)
Due	20 (SDA), 21 (SCL), SDA1, SCL1

Arduino DUE Pin Map



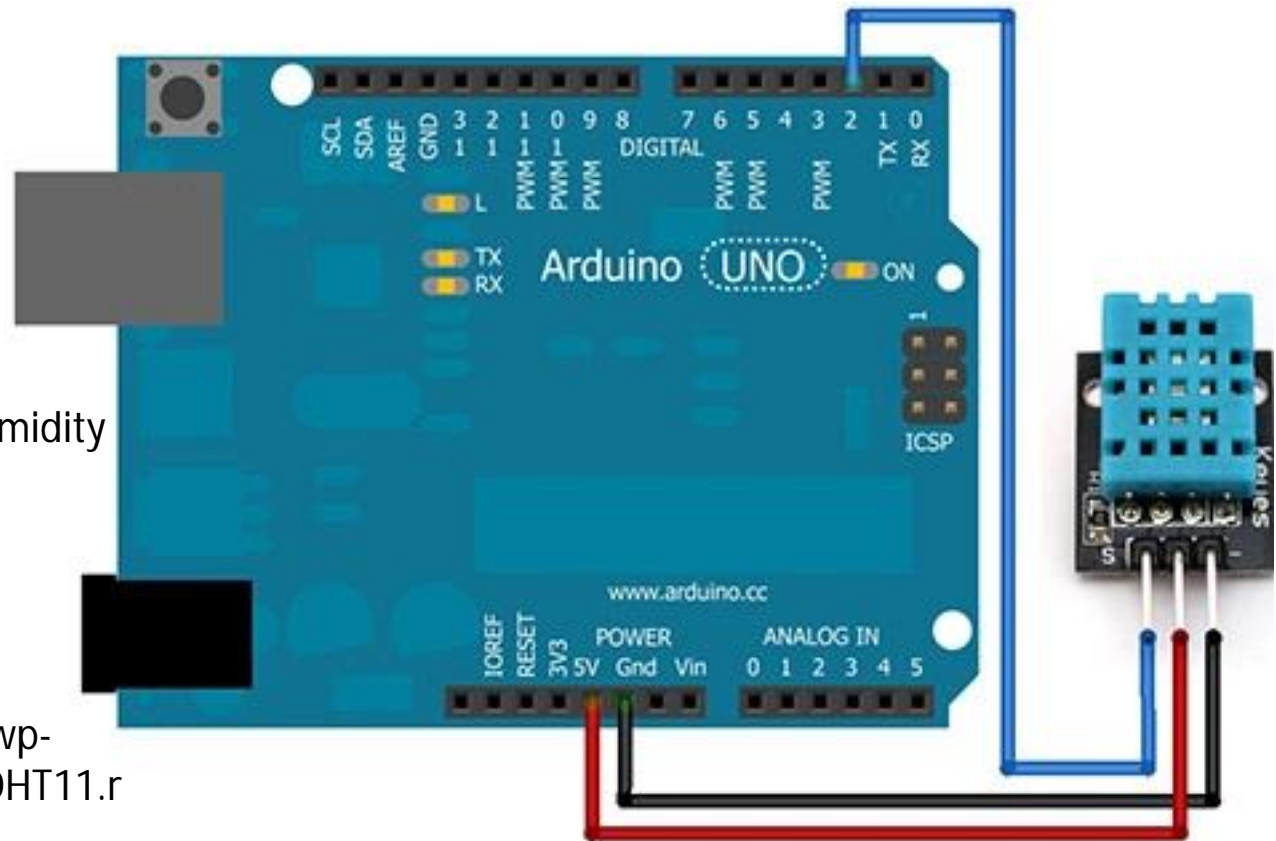
The Circuit

Parts List

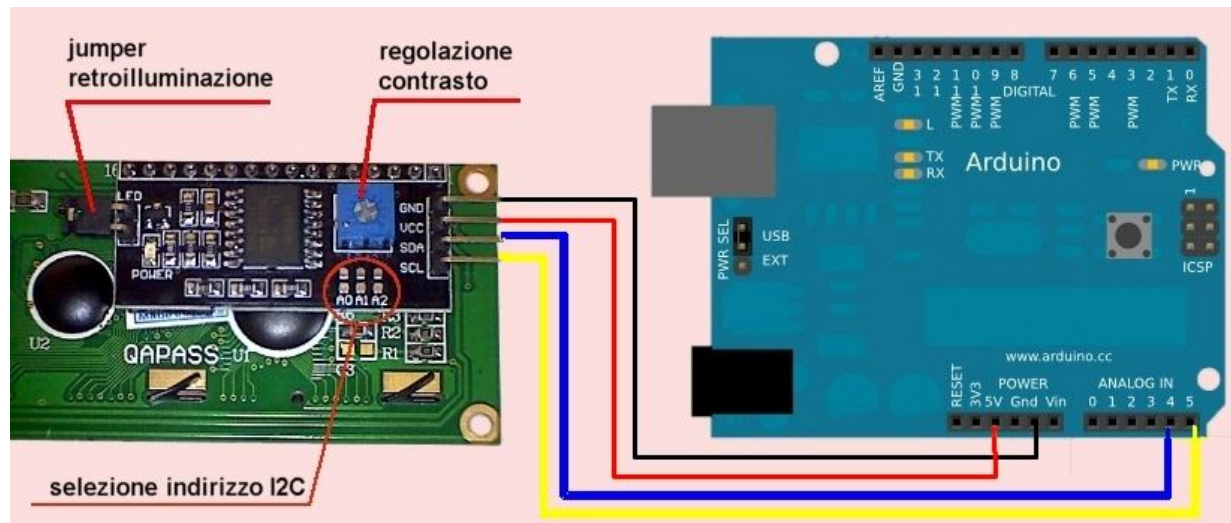
- Arduino
- I2C LCD display 16x2
- DHT11 Temperature and Humidity Sensor

Libraries

- [DHT11 Library](http://www.elec-cafe.com/wp-content/uploads/2015/12/DHT11.rar) (Sensor): <http://www.elec-cafe.com/wp-content/uploads/2015/12/DHT11.rar>
- [Wire Library](#) (I2C communication)
- [LiquidCrystal_I2C Library](http://www.elec-cafe.com/wp-content/uploads/2015/12/LiquidCrystal_I2C.rar) (LCD Monitor): http://www.elec-cafe.com/wp-content/uploads/2015/12/LiquidCrystal_I2C.rar



The Circuit



PCF8574T	Arduino
SDA	SDA
SCL	SCL
Vcc	+5V
GND	GND

The Code

```
#include <DHT11.h>
#include <LiquidCrystal_I2C.h>
#include <Wire.h>

Int pin=4;
DHT11 dht11(pin);
LiquidCrystal_I2C lcd(0x27, 16, 2);

double Kelvin(double celsius){
  return celsius + 273.15;
}

void setup() {
  // put your setup code here, to run once:
  lcd.begin();
  lcd.backlight();
  lcd.clear();

  lcd.print("HUM & TEMP");
  delay(2000);
  lcd.clear();

  lcd.print("Starting .....");
  delay(2000);
}
```

```
void loop() {
  // put your main code here, to run repeatedly:
  int err;
  float temp, humi;
  if((err=dht11.read(humi, temp))==0)
  {
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("temp: ");
    lcd.print(Kelvin(temp));
    lcd.print(" K");
    lcd.setCursor(0,1);
    lcd.print(" hum: ");
    lcd.print(humi);
    lcd.print(" %");
  }
  else
  {
    lcd.println();
    lcd.print("Error No :");
    lcd.print(err);
  }
  delay(DHT11_RETRY_DELAY);
}
```

Contenuto kit

- 1 scheda ProtoShield con mini breadboard;
- 1 Breadboard MB102 830 punti;
- 15 LED (5 rossi, 5 verdi, 5 gialli);
- 10 Resistori metal film da 10KOhm;
- 10 Resistori metal film da 1KOhm;
- 10 Resistori metal film da 220 Ohm;
- 1 Circuito integrato SN74HC595 8-bit Shift Register;
- 1 Buzzer attivo;
- 1 Buzzer passivo;
- 10 pulsanti 12*12*7.3;
- 3 Fotoresistori;
- 1 Potenziometro da 10kOhm;
- 1 Sensore di temperatura LM35DZ LM35 TO-92;
- 1 Sensore di fiamma ad infrarossi;
- 1 Ricevitore ad infrarossi HS0038B HS0038 SIP3 TO-92;
- 2 Sensori di inclinazione(Tilt Sensor);
- 1 Tilt Sensor Switch;
- 1 modulo LCD Blu 1602 con interfaccia seriale IIC/I2C/TWI;
- 1 modulo joyStick PS2;
- 1 Motore Stepper 5V con scheda drive ULN2003;
- 1 Servo motore compatibile SG90;
- 1 Modulo RGB 3 Colori;
- 1 Modulo Relè ad 1 canale 5V;
- 1 kit jumper wire (65 pezzi);
- 10 pezzi Dupont Line (F a M);
- 1 Header femmina 2.54mm 1x40 Pin Single Row;
- 1 case per batterie 6-AA-1.5V;
- 1 Modulo Real Time Clock RTC DS1302;
- 1 kit RFID con Card read/write;
- 1 Modulo Sensore di suono;
- 1 Modulo Sensore di Temperatura e umidità DHT11;
- 1 Tastiera a matrice 4x4;
- 1 Modulo Display 8x8 Dot-Matrix 32x32 mm;
- 1 Modulo Sensore del livello dell'acqua;

Ultima Esercitazione

- Gruppo 1: Sensore Temperatura -> illumina n°led proporzionali alla T letta
- Gruppo 2: Sensore Fiamma IR -> fa lampeggiare led quando rileva la presenza della fiamma
- Gruppo 3: Ricevitore IR -> fa accendere led diversi in base al pulsante che premo (2 led/2pulsanti)
- Gruppo 4: Ricevitore IR -> fa accendere led premendo un pulsante sul telecomando
- Gruppo 5: Tilt Sensor -> fa accendere led verde quando è dritto (on), rosso quando è spento
- Gruppo 6: Tilt Sensor -> fa lampeggiare il led quando è capovolto
- Gruppo 7: Relè -> spegnere ed accendere led tramite il relè
- Gruppo 8: Sensore Suono -> accende led verde quando c'è silenzio, rosso quando rileva un rumore
- Gruppo 9: Joystick -> accendo led di colore diverso in base alla direzione in cui muovo il joystick
- Gruppo 10: Sensore livello acqua -> illumina n°led proporzionali al livello di acqua rilevato