

# Arduino Code

## For Carbon Dioxide detection in air

This code communicates with the [MQ135](#) air quality sensor. The sensor is supposed to preheat for 24 hours before taking readings. Once the code runs, it prints out the concentration of detected gases in ppm on a serial monitor and the results are displayed on an LCD screen. An alarm system (LED light) is also set to glow if the CO<sub>2</sub> values cross a threshold value of 1000ppm.

```
#include "MQ135.h"
#include <Wire.h>
#include <LiquidCrystal_I2C.h> //Header file for LCD

LiquidCrystal_I2C lcd(0x27,16,2); //set the LCD address to x27 for a 16 chars
and 2 line display

#define led          9                //led on pin 9
const int gas_pin = A0;              //analog feed from MQ135
MQ135 gasSensor = MQ135(gas_pin);

void setup(){

  lcd.init();                        // initialize the lcd
  lcd.begin(16,2);                   // consider 16 chars + 2 lines lcd
  lcd.backlight();                   // illuminate to produce visible reading
  lcd.clear();                       // clear lcd
  lcd.setCursor(4,0);                //set cursor of lcd to 1st row and 5th
column
  lcd.print("Group L");              // print as a sentence on lcd

  pinMode(gas_pin,INPUT);            //MQ135 analog feed set for input
  pinMode(led,OUTPUT);               //led set for output
  Serial.begin(9600);                //serial comms for debugging
}

void loop(){
  float ppm = gasSensor.getPPM();
  Serial.println(ppm);                // print ppm on serial monitor
  delay(1000);
  lcd.clear();                       // clear lcd
  lcd.setCursor(0,0);                // set cursor of lcd to 1st row and 1st
column
  lcd.print("Air Quality: ");        // print as a sentence on lcd
  lcd.print(ppm);                    // print value of MQ135
  if(ppm>999){                        //if co2 ppm > 1000
    digitalWrite(led,HIGH);          //turn on led
    lcd.setCursor(2,1);              // set cursor of lcd to 2nd row and 3rd
column
```

```
    lcd.print("AQ Level BAD"); //print as a sentence on lcd
  }
  else{
    digitalWrite(led,LOW);          //turn off led
    lcd.setCursor(1,1);            // set cursor of lcd to 2nd row and 2nd
column
    lcd.print ("AQ Level Good");  // print as a sentence on lcd
  }
}
```

## For noise disturbance detection in the environment

```
/* This code is meant to monitor the sound intensity using LM393 sensor
connected to Arduino UNO board.
//The used sensor has only a digital output. Therefore, the number of times
the sensor detects a sound is summed up over a sampling time called
"SAMPLE_TIME".
//Then the sum called "sampleBufferValue" is printed on a Serial Monitor
(laptop), and visualized with the Serial Plotter.
// The code allows to communicate with a LED in order to provide a visual
alarm if the "sampleBufferValue" surpasses a preset Threshold "Threshold"
*/

// 0 means silence and 1 means noise

const int OUT_PIN = 12;          // The OUTPUT of the sound sensor is
connected to the digital pin D12 of the Arduino
const int SAMPLE_TIME = 10;     // The sampling time in milliseconds, can
be set differently if required
const int Threshold = 90;       // Threshold on decibel value for LED
switching ON, the value has been optimized with respect to the used sampling
time (900 cumulative digital counts  $\approx$  90 dB from "Schall")

unsigned long millisCurrent;     // current time
unsigned long millisLast = 0;    //previous time
unsigned long millisElapsed = 0; // difference between current time and
previous time (time interval)

int sampleBufferValue = 0;       // initiate the sum of digital outputs
over the sampling time
int led = 8;                     // LED on pin 4 of Arduino
int dB = 0;                      //initiate sound intensity dB value

void setup() {

  Serial.begin(9600);            //Arduino starts serial communication with
baud rate 9600
  pinMode(led,OUTPUT);          // the LED is connected as output for alarm
```

```
purpose
}

void loop() {

    millisCurrent = millis();           //the current time is
assigned to the dedicated variable
    millisElapsed = millisCurrent - millisLast; //the elapsed time is updated
    if(digitalRead(OUT_PIN) == HIGH){    //HIGH means noise
        sampleBufferValue++;           //increments the sum variable
by 1
    }
    if (millisElapsed > SAMPLE_TIME) {    //if the elapsed time surpasses
the sampling time, print the sampleBufferValue and test threshold for alarm
        dB = 0.0666 *(sampleBufferValue) + 30.223; //linear regression to
calculate the decibel value based of the rough calibration of the sensor
response
        Serial.println(dB);           // print decibel values on the
Serial Monitor
        Serial.print("dB");           // print sound unit decibel
        if (sampleBufferValue > Threshold) { // test if the threshold is
surpassed
            digitalWrite(led, HIGH);    //blink LED 2 ms ON and 1 ms OFF
            delay(2);
            digitalWrite(led, LOW);
            delay(1);
        }
        digitalWrite(led, LOW);        // the LED is turned off to be
ready for the next sample
        sampleBufferValue = 0;         // re-initialization of the
sampleBufferValue variable for the new sampling time
        millisLast = millisCurrent;    // update the previous time to be
the start for the next sample
    }
}
```

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