

Arduino Code

For Carbon Dioxide detection in air

```
/*
 // This code communicates with the MQ135 air quality sensor. The sensor is
 supposed to preheat for 2 mins before taking readings
 // Once the code runs, it prints out the concentration of detected gases
 in ppm on a serial monitor and a LCD 20 x 4 screen
 //An alarm system (LED light) is also set to print out messages saying if
 the air is of a good quality relying on a predefined threshold value
 */
 // digital output value is converted to ppm value using CO2 gas as
 parameter
#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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