

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 = 900; // Threshold on cumulative counts for LED
switching ON, the value has been optimized with respect to the used sampling
time of 10 ms here. (900 digital outputs ≈ 90 dB from "Shall")

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

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 the threshold for the
alarm
    dB = 0.0666 *(sampleBufferValue) + 30.223; //linear regression to
calculate the decibel value based of the rough clibration of the sensor
response
    Serial.println(dB); // print decibel values on the Serial Monitor
    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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