Kitchen safety sensor

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Abstract. Most cases of house fires or gas leaks are taking place in the kitchen. We created a device that can detect both and alert the owner that he has a gas leak in the kitchen or a fire. This device can be placed in other spaces, but it was intended for kitchen use. In the following paragraphs we give a short description about the idea of a safety sensor, manufacturing details, utilities, diagram and code.

1. Introduction

While the impact of forest fires on residential communities has received a lot of press over the last couple of years, cooking is consistently the leading cause of (determined) home fires and fire related injuries. This risk grows with the arrival of autumn and winter and all of the festivities that come with the two seasons. Studies show that Thanksgiving is the peak day for home cooking fires, followed by December 24th and 25th. Frying food is a leading cause of kitchen fires due to the use of oil and resulting fires that are fast spreading.

Gas stoves leak significant amounts of methane when they are being ignited and even while they are turned off, according to a new report, adding to the growing debate over the effects of gas-powered appliances on human health and climate change.

The small study — based on measurements from cooktops, ovens and broilers in 53 homes in California — estimated that stoves emit between 0.8 and 1.3 percent of the natural gas they consume as unburned methane, a potent greenhouse gas. During the course of a typical year, three-quarters of these emissions occur when the devices are shut off, the study showed, which could suggest leaky fittings and connections with gas service lines.

2. Functionality

The most important parts of our device are the sensor modules:
- MQ-2 Gas module sensor for LPG, Butane and Hydrogen detection
- MQ-7 Gas detection module for carbon monoxide

As a main board we use a UNO R3 development board, compatible with Arduino.
The alarm part is made with LEDs and a piezo buzzer.

2.1. UNO R3 development board

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

- **Microcontroller: ATmega328p**

- **USB Chip: CH340G**

- **USB Supply Voltage: 5V**

- **DC connector voltage: 8-12V**

- **Digital I/O pins: 14 (6 supports PWM output)**

- **Analog pins: 6**

- **maximum current on I/O pins: 40 mA**

- **Flash Memory: 32 KB (ATmega328) of which 0.5 KB used by bootloader**

- **SRAM: 2 KB (ATmega328)**

- **EEPROM: 1 KB (ATmega328)**

- **Frequency: 16 MHz**

Figure 1. Arduino UNO R3 Schematics.
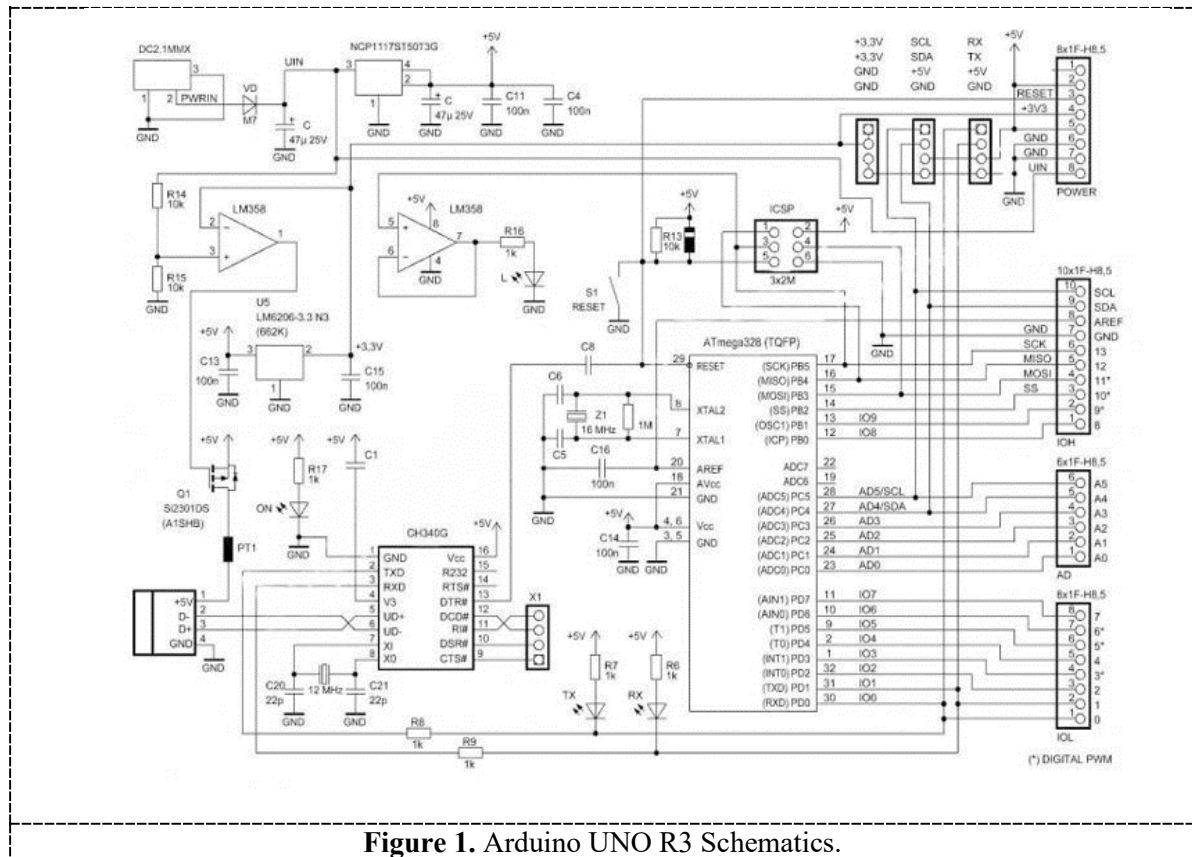
2.2. MQ-2 Gas module sensor for LPG, Butane and Hydrogen detection

The module is used to detect gas leaks in small or large rooms and is a method of precaution for fire or poisoning. The sensor has a high sensitivity and gas main targets that are LPG, isobutane, propane, methane, alcohol, hydrogen and carbon. The sensor has a comparator, so you can read analog data in real time, or you can find out if the gas concentration has exceeded a certain limit.
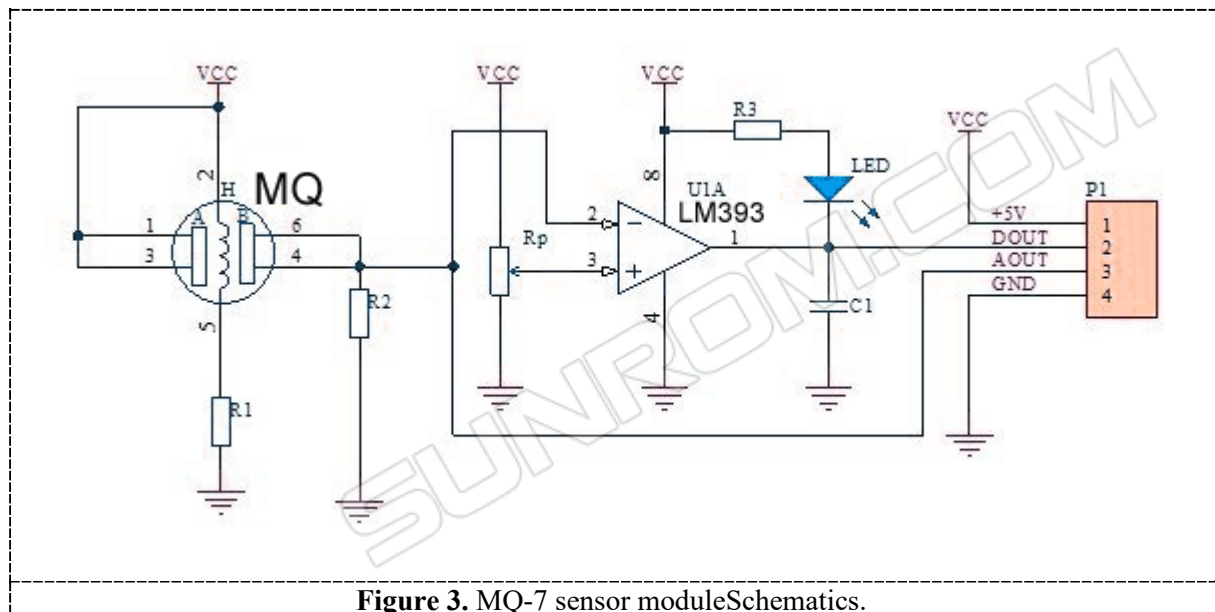
- 5V operation

- LEDs for output and power

- Output sensitivity adjustable

- Analog output 0V to 5V

- Digital output 0V or 5V

Figure 2. MQ-2 sensor moduleSchematics.
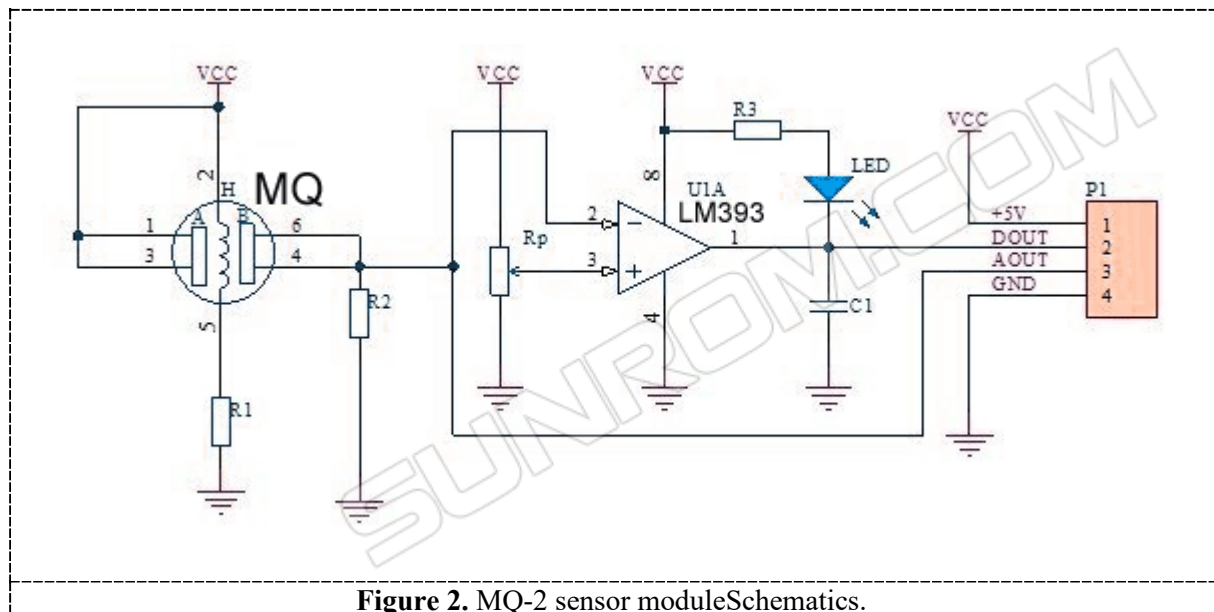
2.3. MQ-7 Carbon Monoxide (CO) Gas Sensor

Used in carbon monoxide (CO) detection equipment in residences and industry or in the car, this module can detect if the CO particles in the air exceed a certain limit.

- 5V operation

- Simple to use

- LEDs for output and power

- Output sensitivity adjustable

- Analog output 0V to 5V

- Digital output 0V or 5V

Figure 3. MQ-7 sensor moduleSchematics.

3. Circuit diagram

Figure 4. Sensor Circuit Schematics.
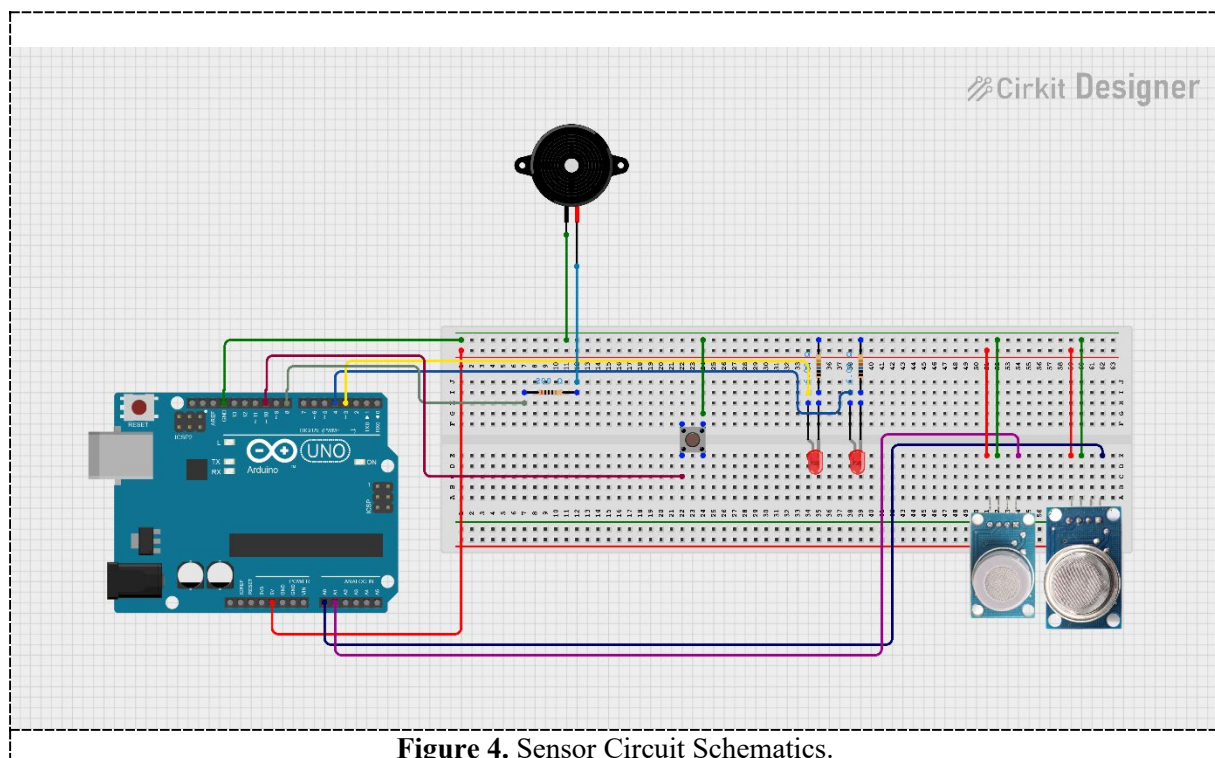
4. Code

```
1  int buzzer = 8;
2  int LED1 = 3;
3  int LED2 = 4;
4  int MQ2 = A0;
5  int MQ7 = A1;
6  int button = 10;
7
8  float sensor1Value;
9  float sensor2Value;
10
11
12 void setup() {
13   // put your setup code here, to run once:
14   pinMode(buzzer, OUTPUT);              //buzzer for noise on pin 8
15   pinMode(LED1, OUTPUT);                //led on pin 3
16   pinMode(LED2, OUTPUT);                //led on pin 4
17   pinMode(MQ2, INPUT);                  //analog input for MQ-2 sensor
18   pinMode(MQ7, INPUT);                  //analog input for MQ-7 sensor
19   pinMode(button, INPUT_PULLUP);        //button to reset sensor
20
21
22
23   Serial.begin(9600); // sets the serial port to 9600
24   Serial.println("Sensors warming up!");
25   delay(20000); // allow the sensors to warm up
26
27 }
28
29 void loop() {
30   // put your main code here, to run repeatedly:
31   sensor1Value = analogRead(MQ2);    // read analog input pin 0
32   sensor2Value = analogRead(MQ7);    // read analog input pin 1
33
34   Serial.print("Sensor1 Value: ");
35   Serial.print(sensor1Value);           //prints value of MQ-2 sensor
36   Serial.print("\n");
37   Serial.print("Sensor2 Value: ");
38   Serial.print(sensor2Value);           //prints value of MQ-7 sensor
39   Serial.print("\n");
40   Serial.println(digitalRead(button));  //prints 1 if the button is
41 pressed else prints 0
42
43   while(sensor1Value > 100 )            //while the value of MQ-2 sensor
44 is over 100
45   {
46     Serial.print(" | GAS detected!");
47     Serial.print("\n");
48     tone(buzzer, 440);                  // Send A sound signal...
49     digitalWrite(LED1, HIGH);           // Turn the LED on
50     delay(300);                         // ...for 300 miiliseconds
51     noTone(buzzer);                     // Stop sound...
52     digitalWrite(LED1, LOW);            // Turn the LED off
```

```
53    delay(300);
54
55    if(digitalRead(button)==LOW)        //if button is pressed
56       {
57          break;                        //reset the detection
58
59       }
60  }
61
62  while(sensor2Value > 100)                        //while the
63 value of MQ-2 sensor is over 100
64  {
65    Serial.print(" | high level of CO detected!");
66    Serial.print("\n");
67    tone(buzzer, 440);                   // Send A sound
68 signal...
69    digitalWrite(LED2, HIGH);            // Turn the LED
70 on
71    delay(300);                          // ...for 300
72 miiliseconds
73    noTone(buzzer);                      // Stop sound...
74    digitalWrite(LED2, LOW);             // Turn the LED
75 off
76    delay(300);

      if(digitalRead(button)==LOW)         //if button is
  pressed
         {
            break;                         //reset the
  detection
         }
     }
}
```

5. Functionality

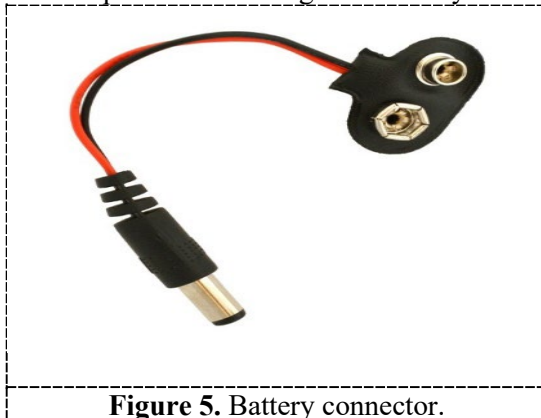- Power up the sensor using a 9V battery connector

Figure 5. Battery connector.

- The device will power up and start heating up the sensors for 20 seconds

- After 20 seconds the device is ready to use, if it false triggers at startup check wire connection and hold down reset button until it resets, be careful that there is no more smoke or gas in the room.

- LED1 will detect GAS and LED2 will detect smoke and CO gas

- If you want to reset the device press the button on the breadboard

6.Sources

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[3] Info About Arduino - https://en.wikipedia.org/wiki/Arduino_Uno

[4] MQ-2 Sensor - https://ardushop.ro/en/home/155-gas-module-sensor-lpg-butane-hydrogen.html

[5] MQ-2 Data Sheet - https://www.pololu.com/file/0J309/MQ2.pdf

[6] MQ-7 Sensor - https://ardushop.ro/en/electronics/187-mq-7-gas-detection-module-carbon-monoxide.html

[7] MQ-7 Data Sheet - https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-7.pdf

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[9] Arduino UNO R3 Data Sheet - https://docs.arduino.cc/resources/datasheets/A000066-datasheet.pdf