

# **Demonstration**

**Detection the presence of  
alcohol vapour using Arduino**

20170211\_ 蘋果日報\_Mini Cooper窩打老道炒欄 司機涉醉駕



on.cc

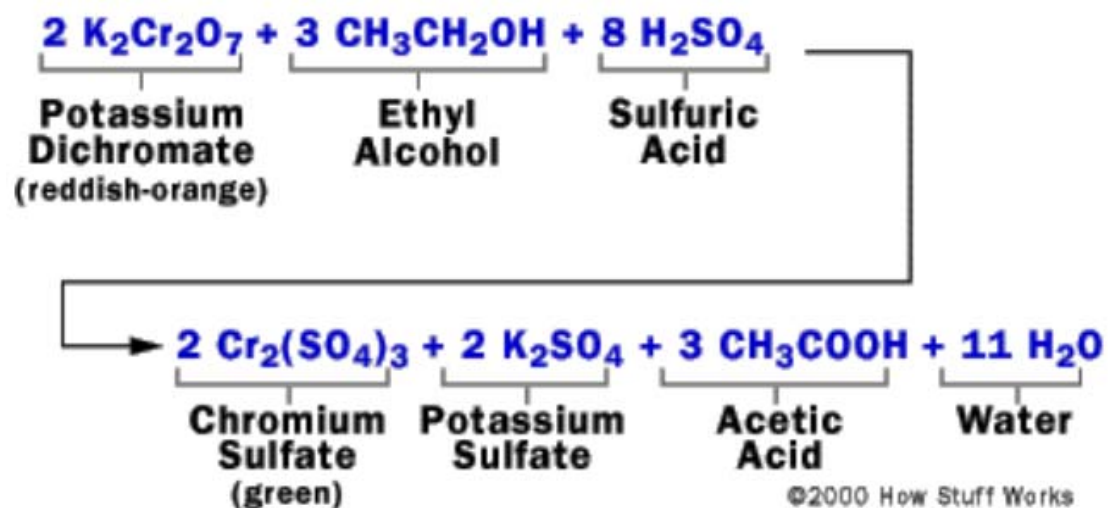
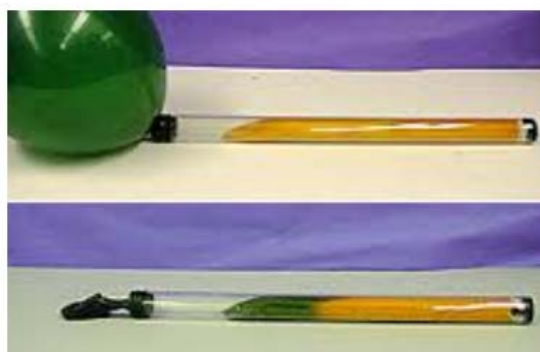


酒精呼氣測試機

# Types of alcohol sensor



# 1. Chemical Test



## 2. Intoxilyzer 氣息分析器 - Infrared sensor

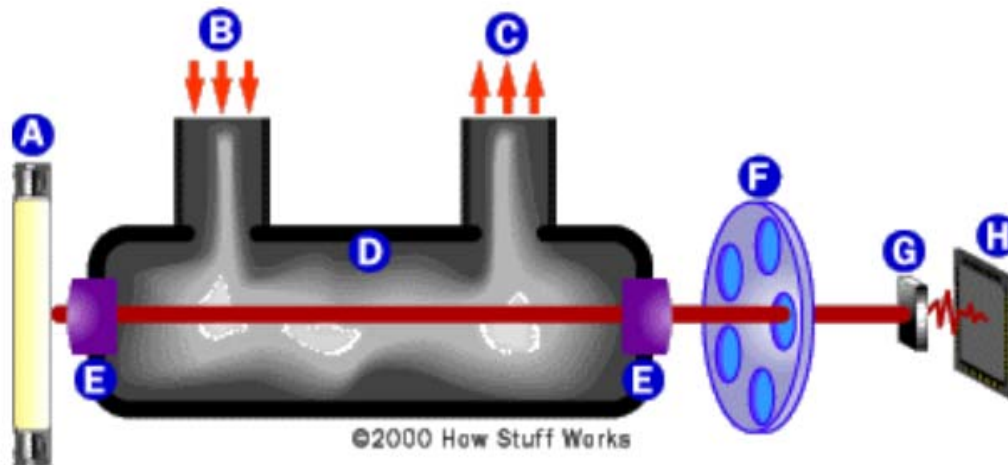
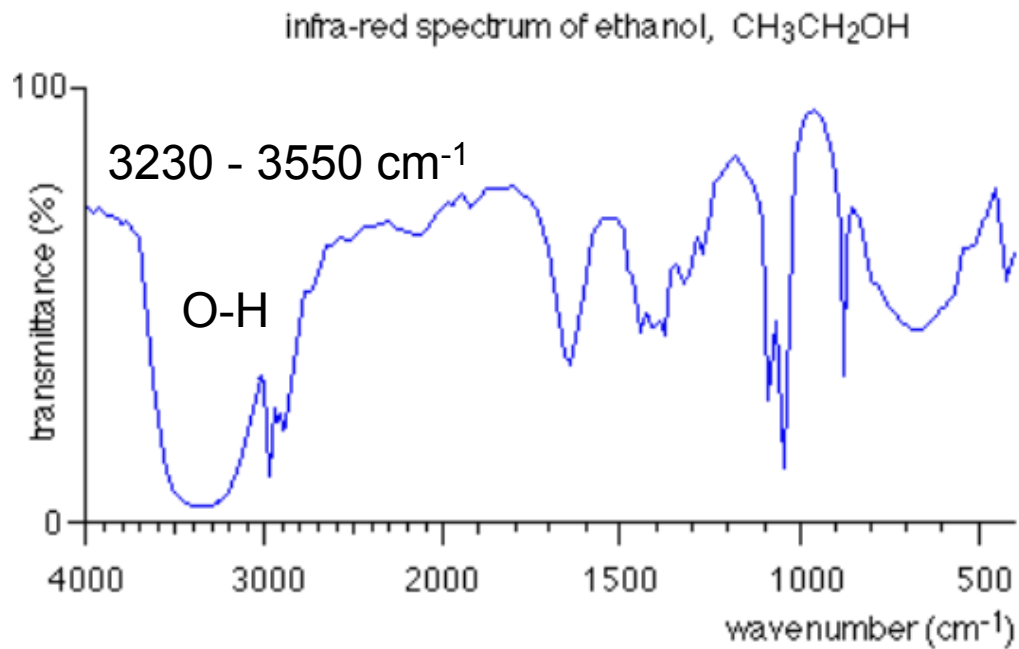


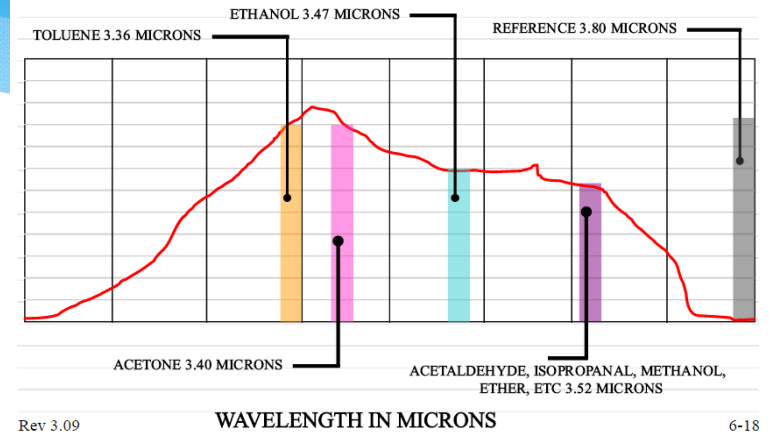
Diagram of the Intoxilyzer

- |                                     |                         |
|-------------------------------------|-------------------------|
| <b>A</b> Quartz lamp<br>(IR source) | <b>E</b> Lenses         |
| <b>B</b> Breath input               | <b>F</b> Filter wheel   |
| <b>C</b> Breath outlet              | <b>G</b> Photocell      |
| <b>D</b> Sample chamber             | <b>H</b> Microprocessor |



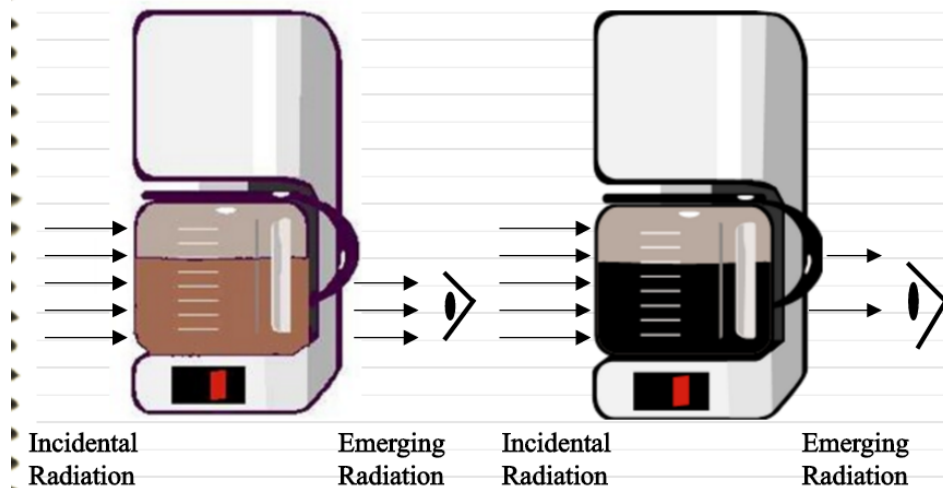


## ABSORPTION BAND OPTICAL FILTERS (TRANSMITTANCE IN PERCENT)



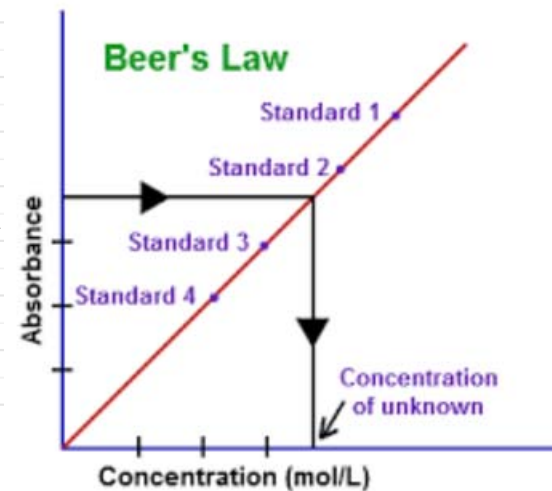
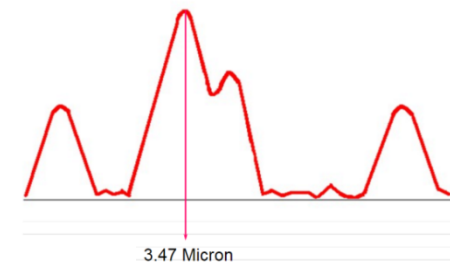
## BASIC SPECTROPHOTOMETRY PRINCIPLES

Less Concentrated/ Appears Lighter      More Concentrated/ Appears Darker



<http://slideplayer.com/slide/7532438/>

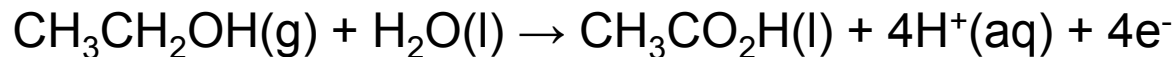
### THE IR FINGERPRINT OF ETHANOL



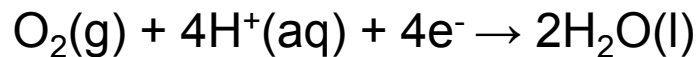
# 3. Breathalyzer - Fuel Cell Sensor

When the user exhales into a breath analyzer

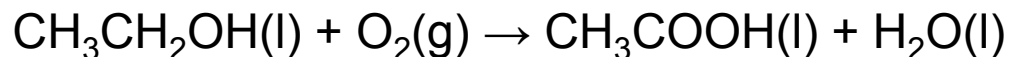
At the **anode**, any ethanol present in their breath is oxidized to acetic acid:



At the **cathode**, atmospheric oxygen is reduced:



The overall reaction :

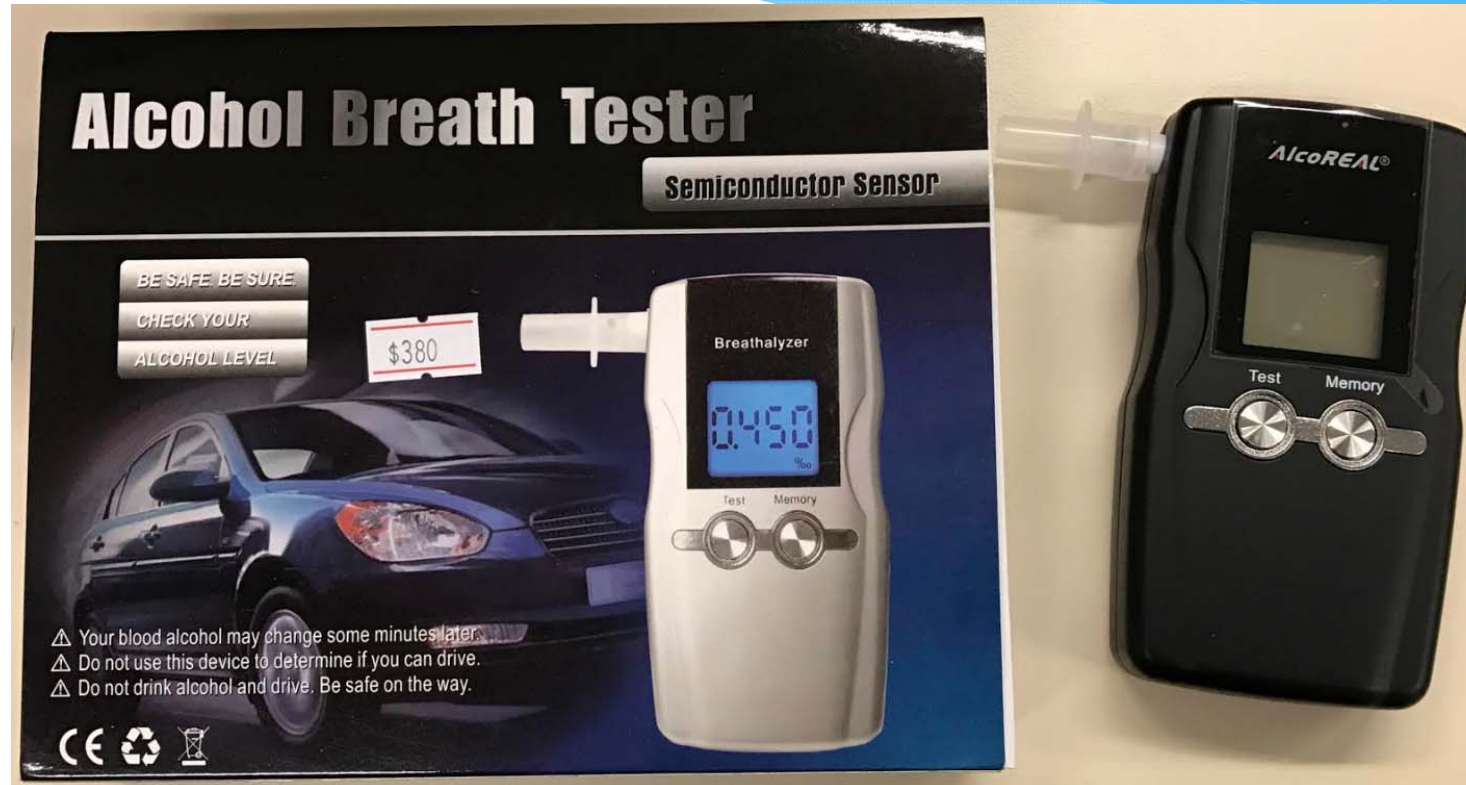


The electrical current produced by this reaction is measured by a microprocessor, and displayed as an approximation of overall blood alcohol content (BAC) by the Alcosensor.





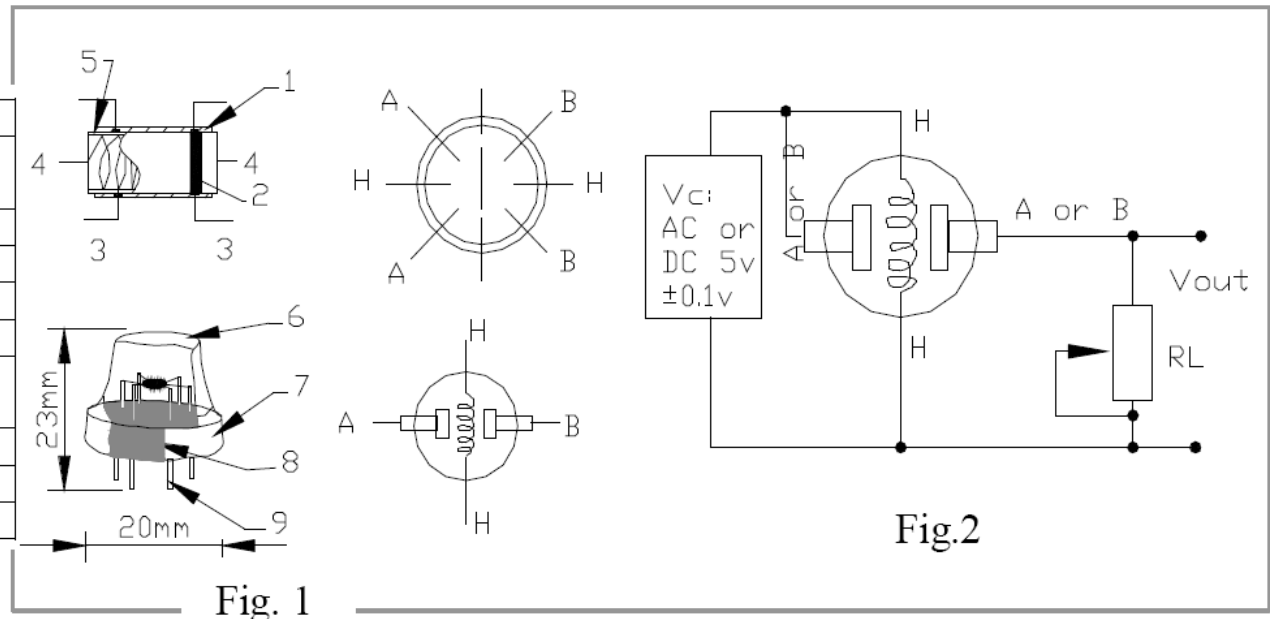
## 4. Breathalyzer – Semiconductor sensor



## Semiconductor sensor (MQ-3)

### D. Structure and configuration, basic measuring circuit

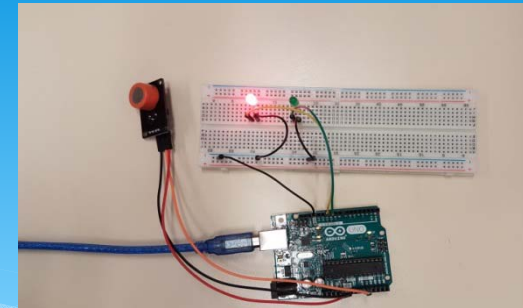
|   | Parts                  | Materials                               |
|---|------------------------|---|
| 1 | Gas sensing layer      | $\text{SnO}_2$                          |
| 2 | Electrode              | Au                                      |
| 3 | Electrode line         | Pt                                      |
| 4 | Heater coil            | Ni-Cr alloy                             |
| 5 | Tubular ceramic        | $\text{Al}_2\text{O}_3$                 |
| 6 | Anti-explosion network | Stainless steel gauze (SUS316 100-mesh) |
| 7 | Clamp ring             | Copper plating Ni                       |
| 8 | Resin base             | Bakelite                                |
| 9 | Tube Pin               | Copper plating Ni                       |



sensor composed by micro  $\text{Al}_2\text{O}_3$  ceramic tube, Tin Dioxide ( $\text{SnO}_2$ ) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net.

Sensitive material of MQ-3 gas sensor is  $\text{SnO}_2$ , which with lower conductivity in clean air. When the target alcohol gas exist, The sensor's conductivity is more higher along with the gas concentration rising.

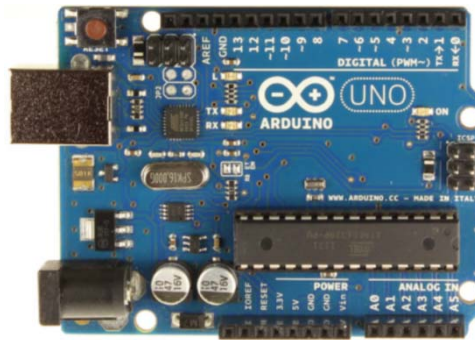
In this demonstration, an arduino alcohol system was developed.



LED lamps



MQ-3  
alcohol  
Sensor



Arduino  
UNO



OLED display



PC Computer

**Input**

**Arduino  
Microcontroller**

**Output**

# Example: Alcohol Detection

## Human Language

Initialize some integer variables to store data like pin number and sensor value

Setup the system

- Set the communication rate between sensor and our computer
- Set pins as power output

Repeat the loop again and again,  
Read **sensor value** from Ao pin, print the **sensor value** at the Serial monitor

An If-else logic decision,

If **sensor value** is smaller than 120, turn on LED\_1

Else turn on LED\_2

Loop again

## Arduinio Codes

```
int AOUTpin = A0;
int sensor_value = 0;
int LED_1 = 10;
int LED_2 = 11;

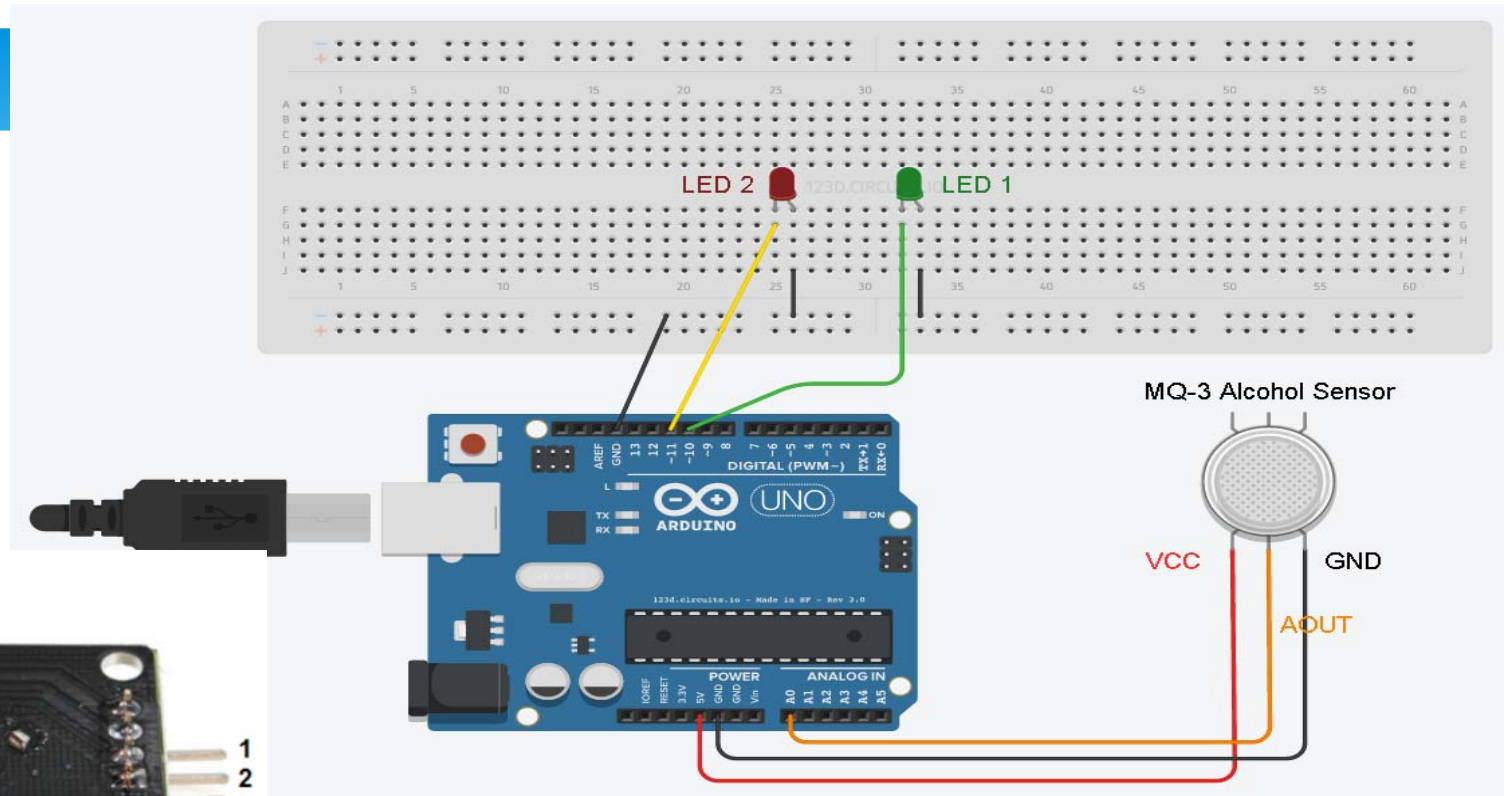
void setup() {
  Serial.begin(9600);
  pinMode(LED_1, OUTPUT);
  pinMode(LED_2, OUTPUT);
}

void loop() {
  sensor_value = analogRead(AOUTpin);
  Serial.print("Recorded value: ");
  Serial.println(sensor_value);
  if(sensor_value < 120){
    digitalWrite(LED_1, HIGH);
    digitalWrite(LED_2, LOW);
  }
  else{
    digitalWrite(LED_1, LOW);
    digitalWrite(LED_2, HIGH); }
}
```





1 = +5V  
2 = DOUT  
3 = AOUT  
4 = GND

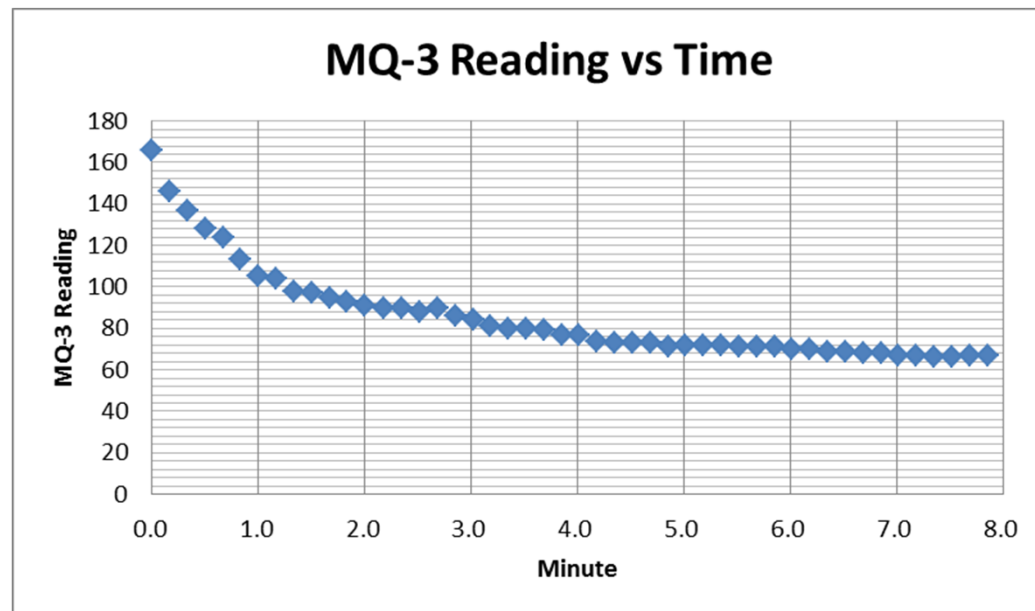
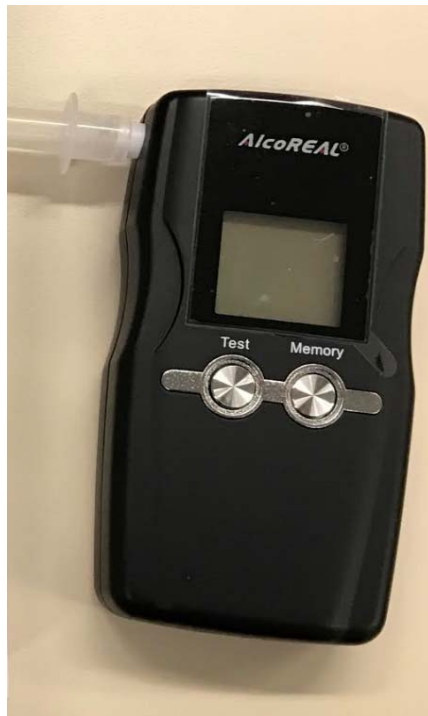
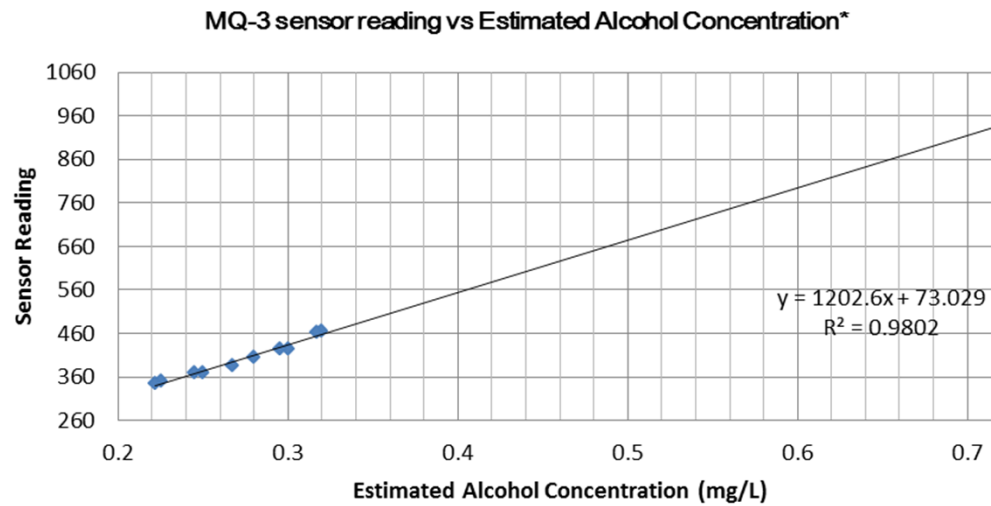


```
int AOUTpin = A0;
```

```
int LED_1 = 10;
```

```
int LED_2 = 11;
```

```
if (sensor_value < 120) {digitalWrite(LED_1, HIGH); digitalWrite(LED_2, LOW)}  
else  
{digitalWrite(LED_1, LOW); digitalWrite(LED_2, HIGH)}
```



The MQ-3 sensor takes about 3~4 minutes to give a smooth background reading according to our experience

# Demonstration

## Breathalyzer - 2 LEDs alcohol arduino system

<https://www.youtube.com/watch?v=Ac6nOvpjegY>

Enhancement of the system



# Measurement of Alcohol Level in breath with OLED display

**Blue**

0-22 micrograms of alcohol per 100ml of breath

**Red**

> 22 micrograms of alcohol per 100ml of breath

**Green**

No alcohol in breath



# Measurement of Alcohol Level in alcoholic beverages

