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SMART SETUP FOR GAS DETECTION USING ARDUNIO

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Abstract: Pollution control board to take the safety measures if the concentration is above the threshold High industrialization and increasing vehicular traffic on the roads have problem of air pollution. Air Pollutants are required to be monitored which are emitted by large number of sources. Inhaling of these harmful gases above the threshold limit may even cause death to persons. As a solution to this issue a portable, low cost, simple Air pollutant gas detection unit has been designed and developed which is capable to detect the poisonous gases like carbon monoxide, explosive gas like methane within seconds and raise alarm if the concentration of any gas is beyond the threshold limit. Commercially available sensors were found sensitive, but less selective towards its target gases. To detect the poisonous gases we use Gas sensors like MQ7 and MQ2. MQ7 gas sensor is used to detect the Carbon monoxide whereas MQ2 gas sensor is used to detect the harmful methane. It is necessary to detect and monitor the poisonous harmful gases like Carbon monoxide and methane. Concentration of gas is monitored and information is send to limit.
Keywords: Flammable gagses,Carbonmonoxide sensor, Methane Sensor,Ardunio

1. INTRODUCTION TO POLLUTION

Natural environment is contaminated with introduction of Pollution. Pollution can appear like heat ,light ,noise, energy or as chemical substance. Pollution is composition of pollutants which are natural compositions or the overseas particles. Pollution often classified as point source or non point source pollution. Major forms of pollution are Air pollution, Light pollution, Noise pollution, Thermal pollution, Water pollution, Plastic pollution. Pollutant will pollute water, soil and air. The factors which gives hardness of pollutant is its persistence, concentration and chemical nature. Air pollution produced by ships may alter clouds, affecting global temperatures. Major pollutants are Carbonmonoxide, Methane, Sulphurdioxide, Carbondioxide Butane.Pollution has cost. Manufacturing activities that cause air Pollution impose health and clean-up costs on the whole society

1.1 Sources and causes of pollution

Human made resources and natural resources can cause air pollution. Human man made pollution arises from burning of fuels, construction, mining with leads to increase the coefficients of air pollution equation. India has huge chemical plants, power plants , oil refineries ,petro chemical plants which leads to emission of pollution at chimneys.Presently used air pollution control deveices includes Pollution control devices(Air pollution control) includes Ejector venturi scrubber, Thermal oxidizer, Dust collection systems, Cyclonic spray scrubber, Bag houses Cyclones , Baffle spray scrubber Electrostatic precipitator, crubbers, Mechanically aided scrubber

1.2 Brief on carbon monoxide

CO is a toxic gas produced by the partial burning of carbon based fuels. When living organisms inhale carbon monoxide it reduces oxygen in the blood. None Of the lifes on earth will escape from the effects of CO. CO leads to deadth when inhaled at high concentration and causes long term problems when the concentration is low.Any gas or propane based engine will produce CO, meaning that boaters, truckers, and small aircraft pilots are atrisk from CO fumes as soon as they start their vehicle. carbon monoxidecauses abnormality to health as like causing headache,dizziness,vomiting.

1.3 Different ranges of CO

Level of CO	Health Effects, and Other Information
0 PPM	Normal, fresh air
9 PPM	Maximum recommended indoor CO level
10-24 PPM	Possible health effects with long-term exposure
25 PPM	Max TWA Exposure for 8 hour work-day (ACGIH). Pocket CO TWA warning sounds each hour.
50 PPM	Maximum permissible exposure in workplace (OSHA).
100 PPM	Alaram starts
125 PPM	Second Pocket CO ALARM start (every 10 seconds).

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200 PPM	causes headache and dizziness
400 PPM	Headache and nausea after 1-2 hours of exposure.Life threatening in 3 ho urs. Third Pocket CO ALARM starts (every 5 seconds).
800 PPM	Headache, nausea, and dizziness after 45 minutes; collapse and unconscio usness after 1 hour of exposure. Death within 2-3 hours
1000 PPM 1600 PPM	Loss of consciousness after 1 hour of exposure. Headache, nausea, and dizziness after 20 minutes of exposure. Death within 1-2 hours
3200 PPM	Headache, nausea, and dizziness after 5-10 minutes collapse and unconsciousness after 30 minutes of exposure. Death within 1 hour
6400 PPM. 12,800 PPM	Death within 30 minutes Immediate physiological effects, unconsciousness. Death within 1-3 minutes of exposure

Table:1 Different Ranges Of Carbonmonoxide

2. SEMICONDUCTOR SENSOR FOR CARBON MONOXIDE

The gas sensor is made up of SnO2.The semiconductor sensor is based on the principle of change in the conductivity of the semiconductor material with change in concentration of target gas at particular temperature. The semiconductor material is heated with 1.5V. With the rising concentration of CO the conductivity of material increases. This linearity holds good
Up to 5V of supply. It has Good sensitivity to Combustible gas in wide range, High sensitivity to Natural gas, Long life and low cost, Simple drive circuit. The sensor is used to detect different gases at different heating temperatures.

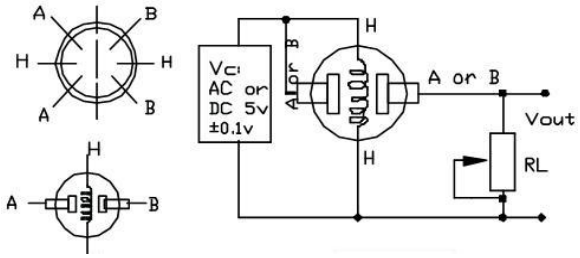

Figure.1 Structure and Configuration of MQ7

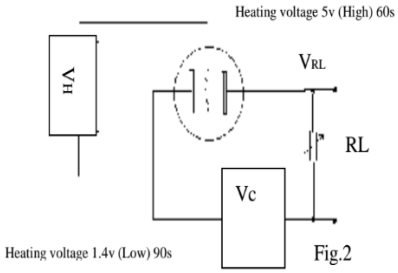

Figure.2 Operating Principle

The sensor contain two important parts, Heating circuit with time control function and signal output circuit which respond to the changes in surface resistance of sensor.
Sensor contains small Aluminum Oxide ceramic tube, a sensitive layer of Tin Dioxide , an electrode for measuring potential and a heating coil are fixed to a shell which is made of plastic and stainless steel net. The Heater is designed so as to provide necessary working condition for the sensitive parts of the sensor. The sensor contains 6 pins out of which 4 are used for fetching signals and 2 pins are used fas output for heating current.

2.1. Sensitvity adjustment

The sensor has to be calibrated for concentration of CO at 200ppm with R_L at 10KΩ.The R_L can vary from 5KΩto 47 KΩ.
The sensor can be operated with -temperature of -20 oc to 50oc.
The surface resistance varies from 2 KΩ to 20KΩ The surface resistance of the sensor Rs is Calculated by getting voltage output signal at load resistance R_L.

$$Rs/RL = (Vc-VRL) / VRL \quad (1)$$

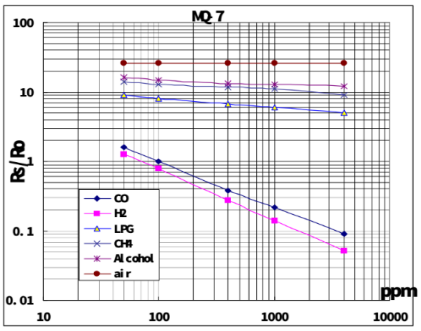

Figure.3Standard resistance graph

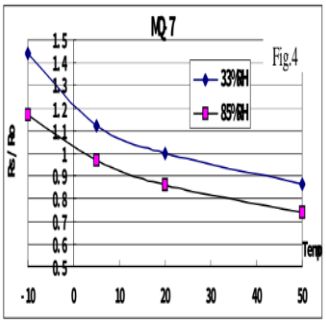

Figure4.Characteristics of MQ7 gas sensor

Sensitivity characteristics of different gases with MQ7 sensor is shown in above figure.3. Above graph shows the typical sensitivity characteristics of the MQ-7 for several gases. At Temperature of 20°C, Humidity of 65%、O2 concentration 21%, RL=10kΩ Ro is defined as sensor resistance at 100ppm concentration of CO in the clean air .Rs is defined as sensor resistance at various concentrations of gases CO sensor concentration is calculated as

PPM = 3.027*e^(1.0698*V_RL) (2)

Above graph shows the typical dependence of the MQ-7 on temperature and humidity. Ro is termed as sensor resistance at 100ppm concentration of CO in air at 33%of relative humidity and 20degree of temperature. Rs is defined as sensor resistance at 100ppm concentration of CO at different temperatures and humidities.

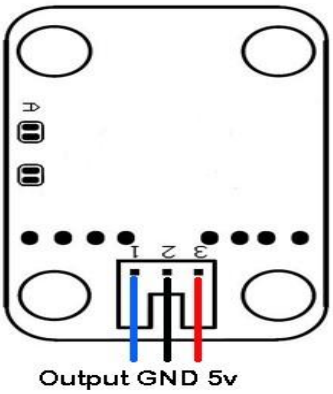

Figure 5.PIN diagram

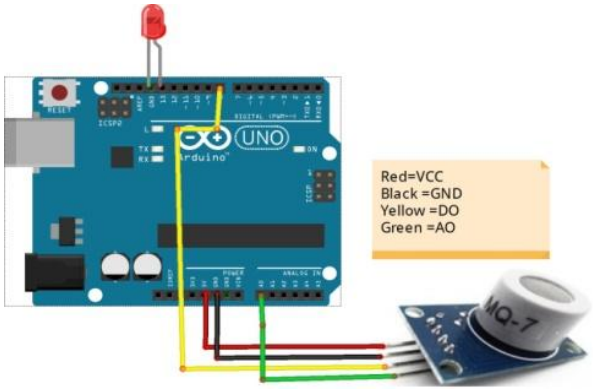

Figure 6: Interfacing of Arduino

3. SEMICONDUCTOR SENSOR FOR METHANE

The MQ2 is a semiconductor gas sensor which detects flammable gases and smoke from 300 ppm to 10,000 ppm .MQ2 sensor detects the concentration of flammable gas and smoke in the air and outputs its reading as an analog voltage. The sensor can operate at temperature from -10 to 50c and consumes less than 150ma at 5v. The conductivity of the sensor increases with the increase of concentration of flammable gases in the atmosphere.

MQ2 gas sensoris highly sensitive to combustable gases. The sensor is capable of detecting different flammable gases at different Temperatuires. The sensor has built in potentiometer whos resistance varies inaccordance to concentration of flammable gas. So the output voltage changes in according to the concentration of gas. The relationship between voltage and gas Concentration is linear.

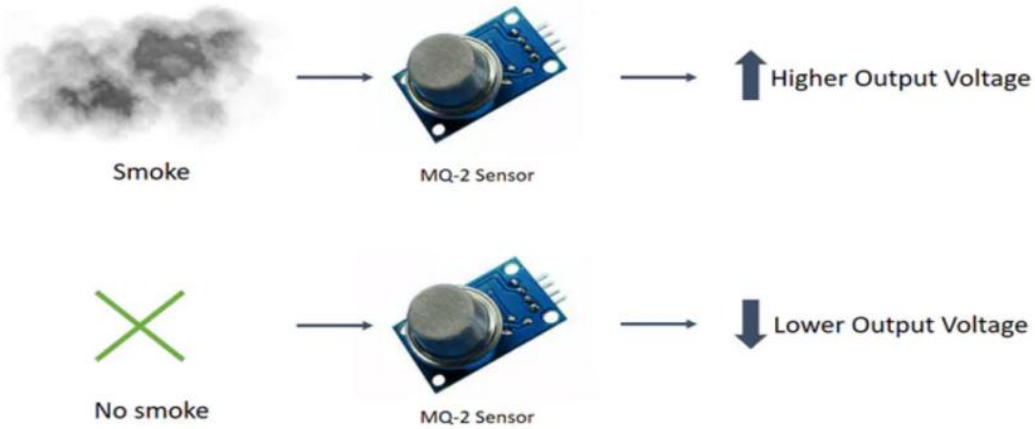

Figure 7: Working Mechanism

3.1 principle of MQ2

The surface resistance of MQ2 is decided from the output voltage at the load resistance R_L which series-wound. The relationship between them is described

Rs/RL = (Vc-VRL) / VRL (3)

Sensitive layer of MQ-7 gas sensitive components is made of SnO2 with stability, it has excellent long term stability. Its life time is 5 years.

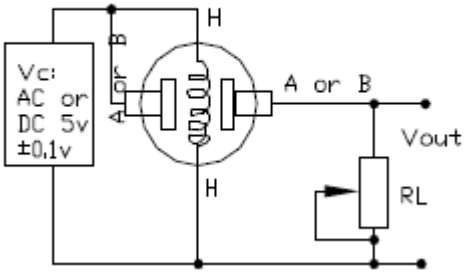

Figure 8 Standard circuit

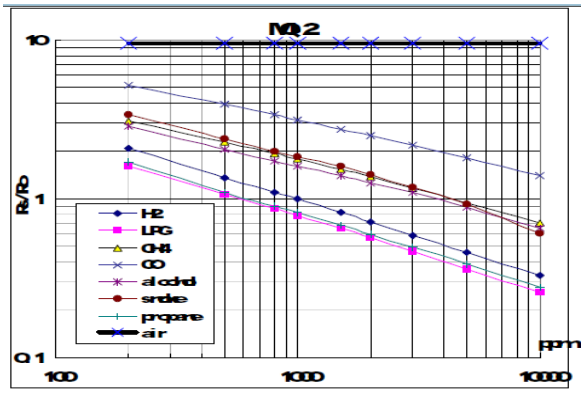

Figure 9:sensitivity characteristic of MQ2 sensor

The above graph shows the typical characteristics of the MQ2 for several gases in their temperature:20c,Humidity:65%,O2 concentration:21% and RL=5Kohm.Where, R0 is the sensor resistance at 1000 ppm of H2 in the clean air and Rs is the sensor resistance at various
concentration of gases.
The above graph shows the typical dependence of MQ2 on temperature and humidity.Where R0 is the sensor resistance at 1000 ppm of H2 in air at 33%RH and 20 degree and Rs is the sensor resistance at 1000ppm of H2 at different temperatures and humidities. Good sensitivity to combustible gases in wide range,Used in gas leakage like smoke methane and liquefied flammable gases.High sensitivity to LPG, Propane and Hydrogen,Wide detecting scope and fast response,simple drive circuit,Long life and low cost.

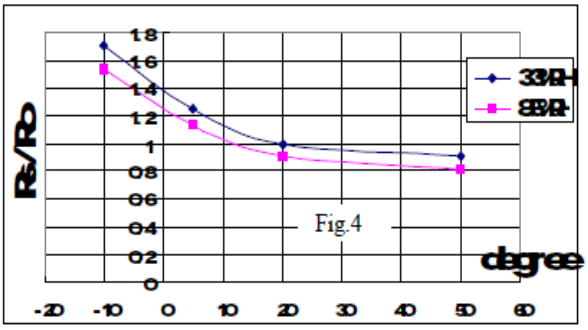

Figure.10 Standard resistance graph

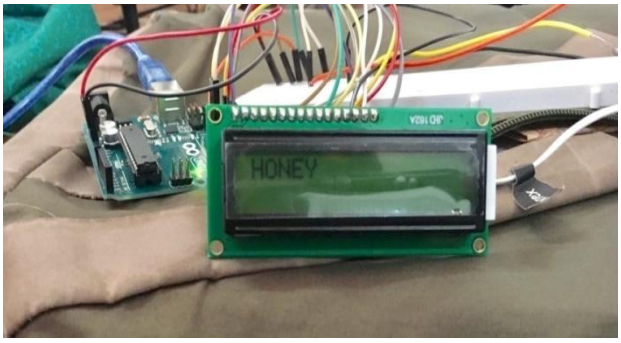

Figure.11 LCD Interface

4. INTERFACING OF DEVICES

The two sensors MQ7 and MQ2 are to be interfaced to Ardunio using following steps

4.1 Process Algorithm

STEP 1: Interfacing between Arduino and LCD display
STEP 2: Interfacing between Arduino and MQ2 Sensor
STEP 3: Interfacing between Arduino and MQ7 Sensor

4.2. Interfacing between arduino and MQ7 sensor

Sensor to Arduino connections is as follows, Vcc to Arduino 5V pin, (i)Ground to Arduino GND pin, (ii) Output to Arduino Analog A0 pin, (iii) Output to Arduino Digital D8 pin

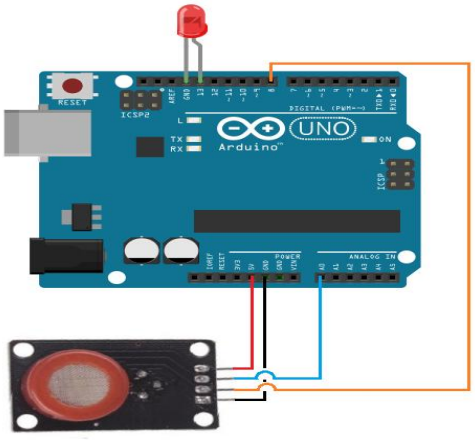

Figure.12 MQ7 sensor program

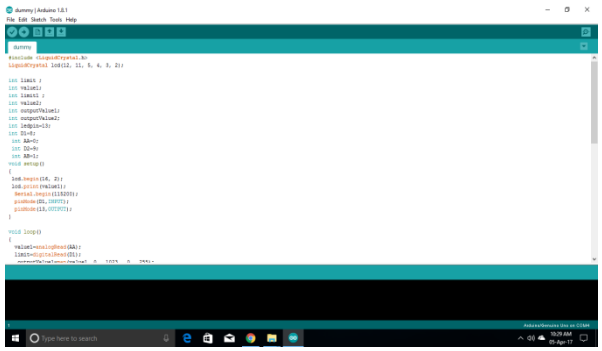

Figure.13 interfacing between arduino and MQ7 sensor:

4.3. Interfacing between arduino and MQ2 sensor

Sensor to Arduino connections is as follows, Vcc to Arduino 5V pin, (i) Ground to Arduino GND pin,(ii) Output to Arduino Analog A0 pin, (iii) Output to Arduino Digital D8 pin

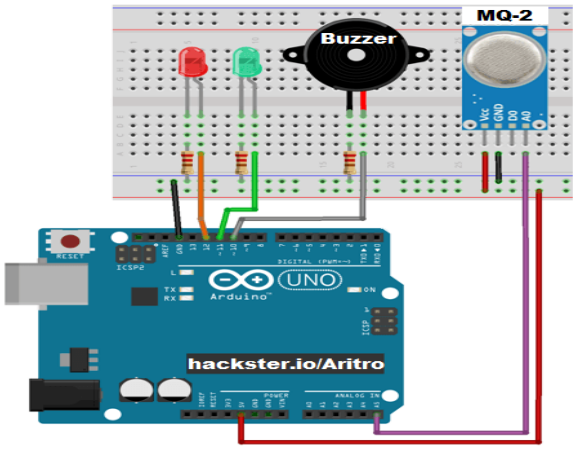

Figure.14MQ2 gas sensor program:

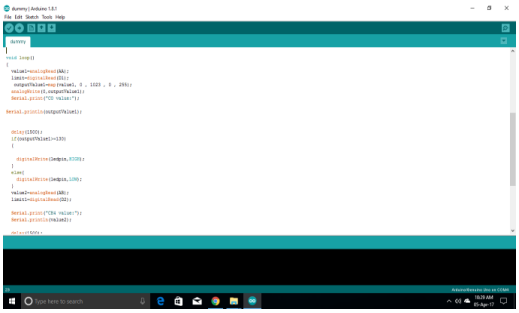

Figure.15 interfacing between arduino and MQ2 sensor:

5. RESULTS

When carbon monoxide is sensed by the MQ7 sensor the LED glows. Carbon monoxide is produced by burning paper. With the increase in the smoke display showed a increase in ppm

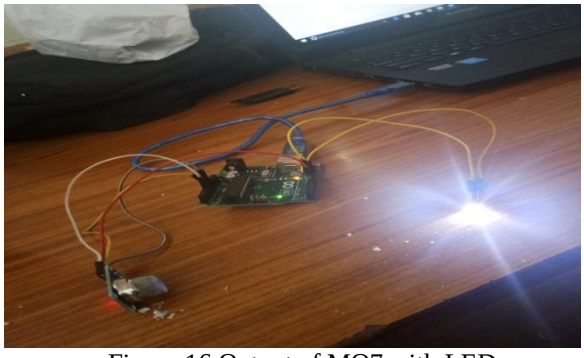

Figure.16 Output of MQ7 with LED

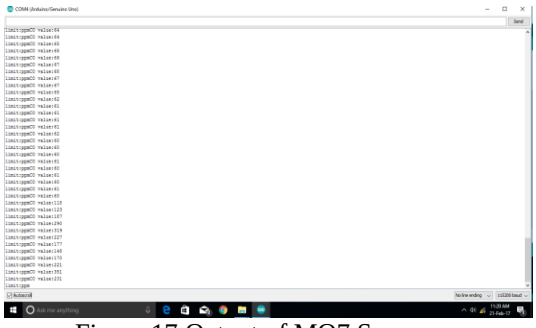

Figure.17 Output of MQ7 Sensor

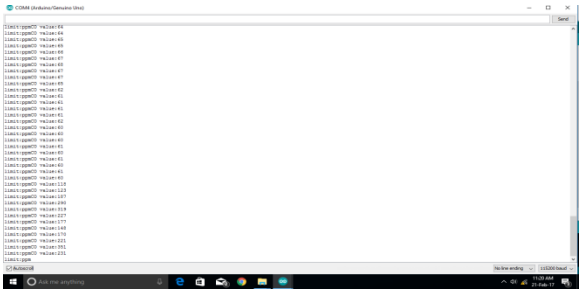

Figure.18 Output of MQ2 Sensor

6. CONCLUSION

By using the above two gas sensors MQ7 and MQ2 we can detect the Carbon monoxide and methane gases. Monitoring of these poisonous gases is required to reduce the pollution and to promote the awareness in the people. The information is send to the pollution control board. Safety measures were taken by the people without effecting from diseases. Vehicle emissions remain a major contributor to air pollution in cities worldwide.

emphasis is made on lighter, more cost effective monitors enables targeted and more dense measurement of roadside emissions. Pollution Control Authorities usually stipulate standards for discharge of environmental pollutants for various categories of industries and common effluent treatment plants (CETPs

7. FUTURE WORK

Advanced sensor for gas detection can be designed using spectroscopic methods which is more effective but expensive