ABSTRACT

A portable engine exhaust gas analyzer can detect and measure Carbon Monoxide (CO), Carbon Dioxide (CO2), Nitrogen Oxide (NO), Nitrogen Dioxide (NO2), and Hydrocarbons (HC's).

A hydrocarbon's channel is calibrated as hexane or propane depending on the vehicle type the analyzer that must be used. The measurement itself is a replica of unburned fuel and is measured in the parts per million(ppm). Modern automobiles in an excellent running condition frequently show 20ppm or even less depending upon the engine geometry.

The amount of CO2 is a product of combustion and replicates the amount of fully combusted fuel. Thereby, a higher CO2 level indicates greater engine efficiency. Many fuel injection engines will produce approximately somewhere nearer to 13% of CO2.

NOx usually refers to NO, NO2, and N2O (Nitric Oxide, Nitrogen dioxide, and Nitrous Oxide) and this measurement are in ppm. This phenomenon occurs usually at higher engine temperatures associated with a lean fuel mixture or when loaded. Out of the NOx output of a typical combination engine, the Nitric Oxide (NO)component will make up the highest in terms of proportion when compared to NO2 and N2O. Diesel engines are commonly associated with the production of greater levels of NOx formation.

This project deals with the building of a portable emission gas analyzer which can detect such harmful pollutants and give an indication to the user about the same. It is economical and cost-effective than any other contemporary analyzer kits which are usually priced extravagantly.

Keywords- Cost-effective.

CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Exhaust gases from the Automobiles are one of the major causes of air pollution and we know that population in this world is never stagnant, it increases day by day and so does the demand for Automobiles. This, however, serves as a good opportunity for automobile manufacturers to increase their production standards but this has setbacks in its own way like increase of the number of vehicles increase the rate of pollutants that are being released from the exhaust gases into the Environment. Pollutants like NOx (NO, NO2, N2O), CO, CO2 and unburnt hydrocarbons present in an automobile exhaust mix up with the air and prove fatal for human respiration. Various measures are taken to minimize the exhaust emissions like the usage of unleaded petrol in SI engines and use of diesel fuel with high Cetane number in Diesel engines, proper design of combustion chamber and much more to name a few. These developments can prove to be no effective if the vehicles are not maintained from time to time with Emission Tests to keep the rate of pollutants in check.

So, this paved way for us the idea of developing a portable emission analyzer one which enables the user to carry the device along with him/her anytime, anywhere and use the same to check for emissions of their respective vehicles on their own. This device works similar to any emission analyzer that is being used in the test centers, it consists of the number of sensors like CO sensors, alcohol sensors (to detect the hydrocarbons), an Arduino board, Breadboard and few other electrical components with suitable electrical adjustments. A typical emission Analyzer Kit cost can go up to $1,476 .41 or even more; this is something which is an extravagant amount of money a person can be paying to make the kit his own. So, this fact also added to our need to develop a cost-effective and a very economical analyzer device.

This project has the equipment designed with alcohol sensor with the adaptation of Arduino board. Due to limited resources the usage of NOx was not possible which will be done in later adaptations to make it more reliable and an efficient working model?

CHAPTER 2

LITERATURE SURVEY

In today's world owning a vehicle is luxury but emission is also most important factor in any vehicle. So, the emission test must be carried out to each vehicle to ensure the control of pollution.

[1] Portable Vehicle Electronic Nose System for Detection of Automobile Exhaust.

This research paper concentrated in the development of the portable automobile exhaust emission analyzer, several issues were considered. First, was the size and weight of the whole prototype. The final product was able to achieve this by using a housing that is as big as an industrial flashlight and can be carried handily by the user. The second factor was the choice of sensors and interface. Since the analyzer does not only measure HC, CO, and NOX but covers also the measurement of opacity, one sensor did not suffice to do all these functions.

[2] A Portable Fibre- Optic Chemical device for the Quantitative determination of carbon monoxide from automobile exhaust emission.

Despite the ever-increasing severity of the European regulations regarding automotive tail-pipe pollution and CO2 emission, real driving emissions (RDE) barely changed over the last almost three decades The European Directive commission accepted Real Driving Emission test in response to the disparagements to the current driving cycle used at chassis dynamometer for homologation purpose(NEDC). It is considered outdated and misleading since air pollutants in real driving conditions are considerably higher than the certification thresholds.

[3] A Continous Flow Method of determining unburned fuel in automotive Exhaust

This paper provides a method to determine “real-world” mass emissions using an on-board low-cost five gas non-dispersive infra-red exhaust gas analyzer, an engine diagnostic scanner and a laptop computer. The computer uses live engine diagnostic port data to compute molar exhaust flow, which, when multiplied by molecular weight and measured concentrations of exhaust gases, yields grams per second data. Grams per mile emissions are calculated from known distance and time of the trip.

[4] Analysis of exhaust gas emission in diesel engine operating with diesel and bio diesel blends.

This Study emphases on use of bio diesel for substitute for currently used fossil fuels. Bio diesel can be used as a good alternative source which is environmental friendly. It is not toxic and doesn't produce as much damaging exhaust emissions.

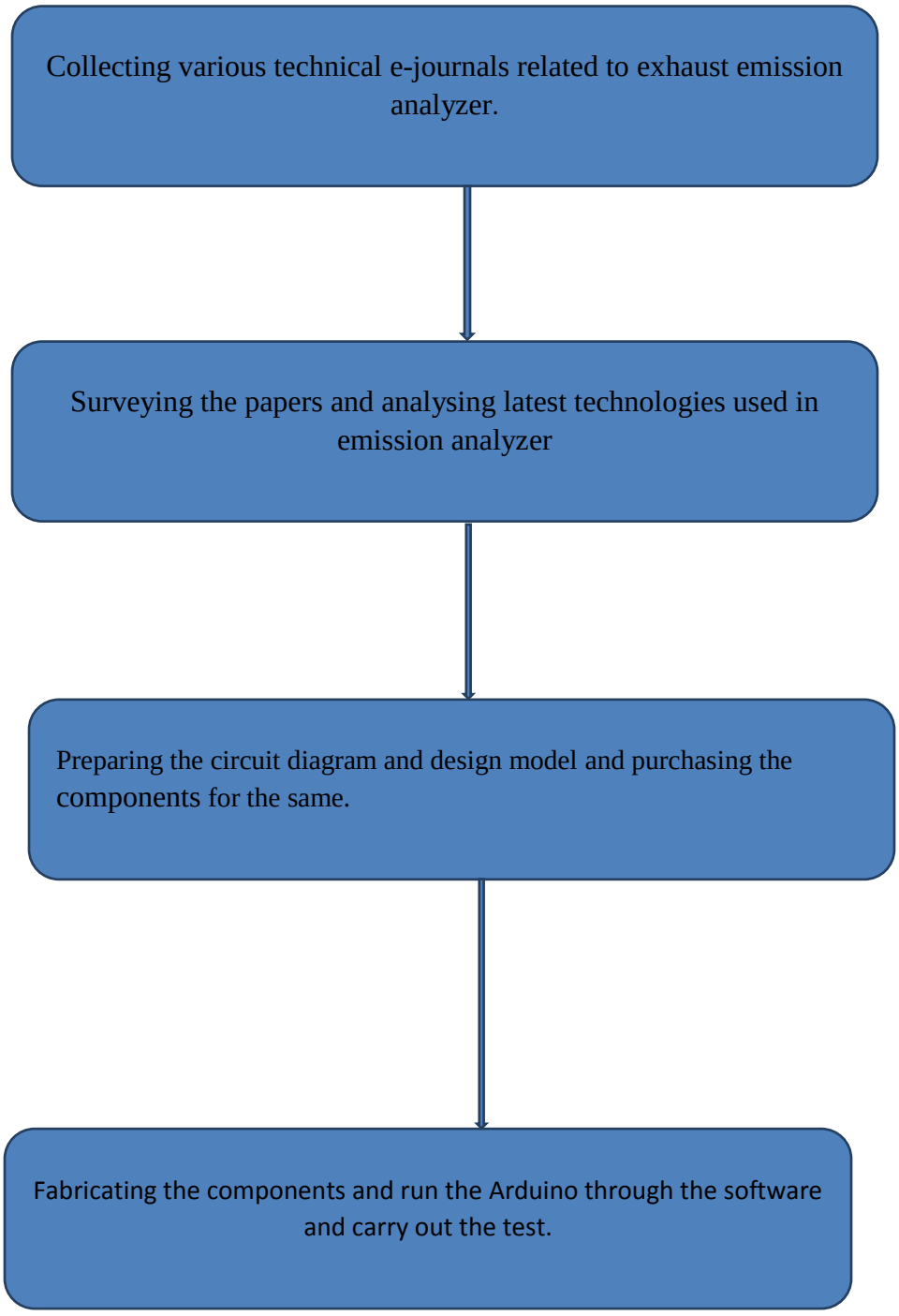
[5] Measurement of Automobile Exhaust Gas hydro carbons

The detailed analysis of engine performance and exhaust emission analysis have been conducted using 3 different volume of organic manganese oxide (E10Mn100, E10Mn150, and E10Mn200) into E10 emulsion fuels. Based on the experimental investigations, E10Mn200achieved the maximum decreased in BSFC. It reduced up to 13.66% of the BSFC in comparison with E10Mn100, and E10Mn150 which only reduced to 2.96%, and 0.49% of the BSFC respectively. The CO emission was reduced to 14.67% when fuelled with E10Mn150 compared to E10.

CHAPTER 3

METHODOLOGY

3.1 FLOW CHART



CHAPTER 4

COMPONENTS

The system that we fabricated contains the following components:

1. Arduino UNO.
2. MQ2 Sensor.
3. Male /Female Jumper Wires or Single Stand wires
4. Bread board.
5. Resistors.
6. LCD.

4.1 Arduino UNO

Arduino Uno is a microcontroller panel built on the ATmega328P. It consists of 14 numerical input/output pins 6 parallel inputs, a 16 MHz quartz crystal, a USB linking, a power jack, an ICSP header and a reset button. The System Contains everything needed for Microcontroller. To mark the release of Arduino Software (IDE) 1.0Uno was chosen which means one in Italian. The Uno panel and version 1.0 of Arduino Software (IDE) were the locus versions of Arduino, The Uno panel is the first in a sequence of USB Arduino panels, and the reference model for the Arduino platform; for an extensive list of present, historical or out-of-date panels see the Arduino catalogue of panels.

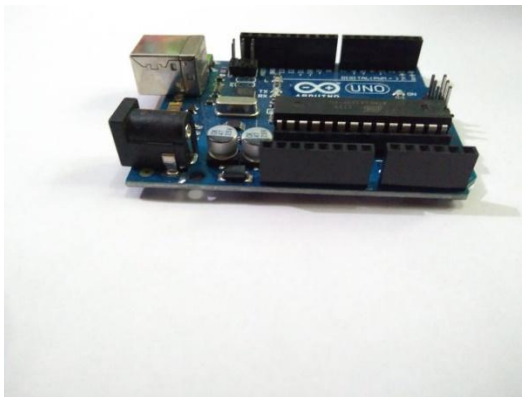


Fig 4.1 Arduino UNO board

4.2 MQ2 Sensor

The Grove - Gas Sensor (MQ2) unit is useful for gas leakage detection (home, industry and exhaust gases). It is appropriate due to its high sensitivity and fast response time, and it is used for the measuring LPG, H2, CO, CH4, Alcohol and Propane and measurement can be taken as soon as possible. Potentiometer is used to measure its sensitivity.

Fig 4.2 MQ2 Gas Sensor

4.3 Male/Female Jumper Wires

It is electrical wire, or group of wires in a cable, with connector or pin at each end or sometimes without them merely or pinned which is normally used to interconnect the components of a breadboard or other prototype or test circuit, inside or with other equipment or components, without fusing.

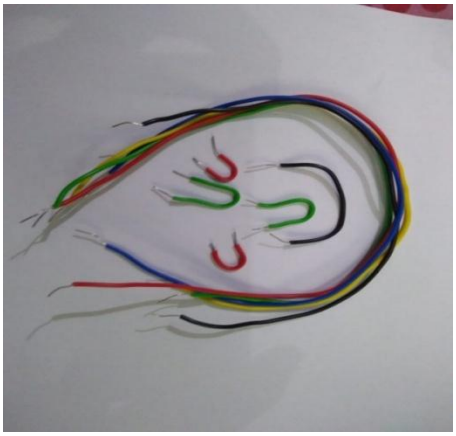


Fig 4.3 Male/Female Jumper wires

4.4 Bread Board

A solder less device used for temporary pattern which includes electronics and trail circuit plans. By inserting their leads or terminals into their holes the electronic components in electronic circuits can be combined and connections can be made through wires when needed.

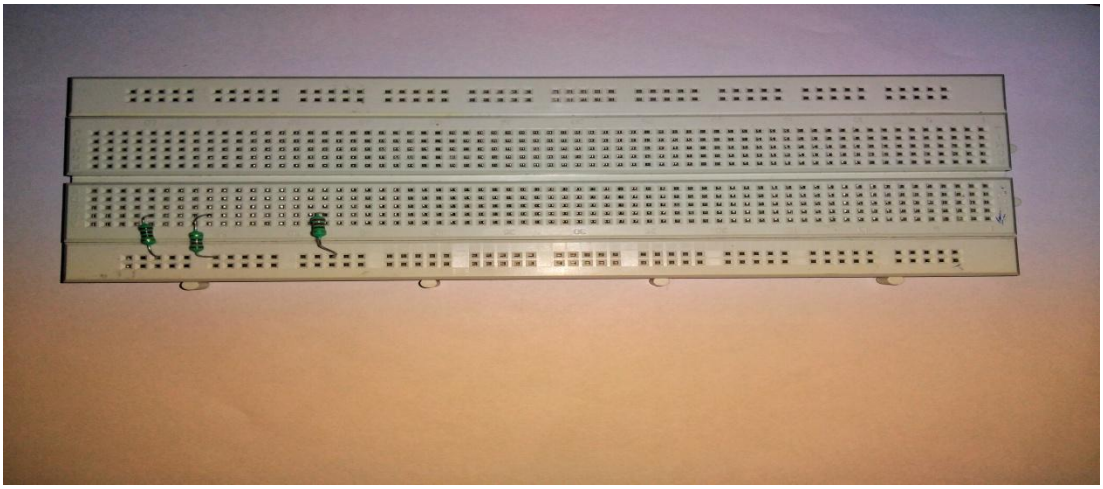


Fig 4.4 Bread Board

4.5 LCD

It stands for Liquid Crystal Display. The LCD display used in this project is 16*2 displays which mean it can show 16 characters in 2 rows. It is Customizable with Arduino easily.

Fig 4.5 LCD

CHAPTER 5

CIRCUIT DIAGRAM

Initially the common relay point is the bread board and all the components such as gas sensor, Arduino, Buzzer and LCD are connected to the breadboard via single strand wires.

MQ2 gas sensor Ao pin is connected to Arduino Ao, MQ2 gas sensor Vcc is connected to Arduino 5volt pin and ground pin is connected to Arduino ground pin. Buzzer positive is connected to common power supply and negative pin is short to the ground .16 Pins of the LCD are connected to the breadboard out of which 12 pins are connected to Arduino. The power supply is provided to the LCD via variable 10k potentiometer and the Arduino is connected to the laptop and the code is compiled and uploaded. Later the whole setup is run. The Following circuit shows the connections explained above.

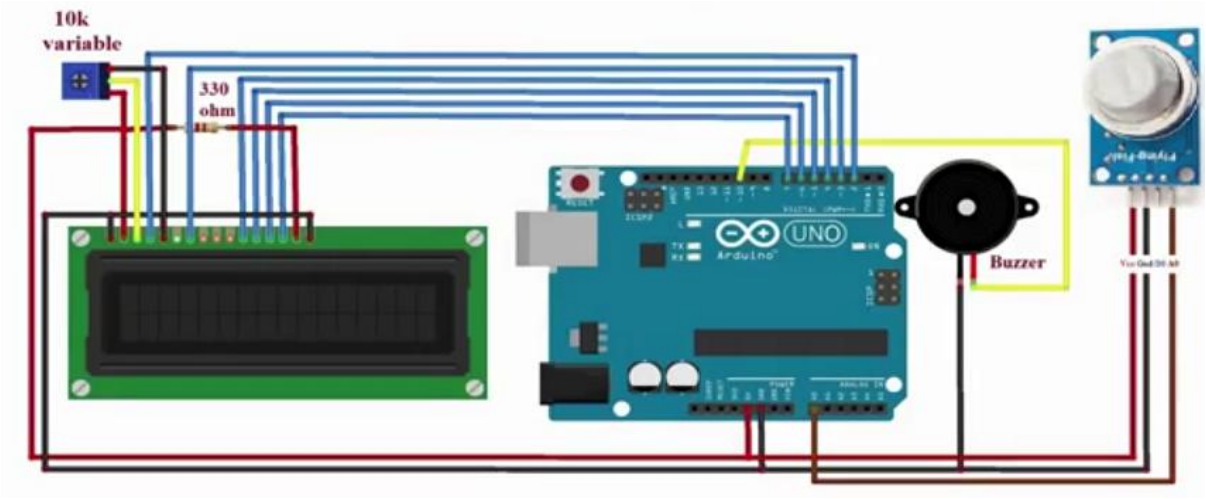


Fig 5.1 Circuit diagram

CHAPTER 6

WORKING

The Main Components is MQ2 Gas sensor. This Sensor is able to detect gases such as butane, propane, alcohol, carbon dioxide and overall smoke in general. This Sensor is highly sensitive and it gives instantaneous values. It has a potentiometer which can be used to vary the sensitivity of the sensor. The Source code is uploaded from the Arduino software version 1.6.2 via USB cable to the Arduino UNO Micro controller chip. The Arduino Board has all the necessary components to run the code from the micro controller to get the desired output. The LCD is connected to the Arduino board in order to display the result. The LCD displays the parameters such as C02 content, LPG content and Smoke in ppm.

6.1 Working

The Working can be discussed in two stages

When there is no detectable gas the MQ2 sensor sends low voltage current to the Arduino and depending upon the parameters set in the source code the schematics in the computer program shows the gas value with the message “NO GAS” the same is displayed on the LCD. The same is showed below in the fig.

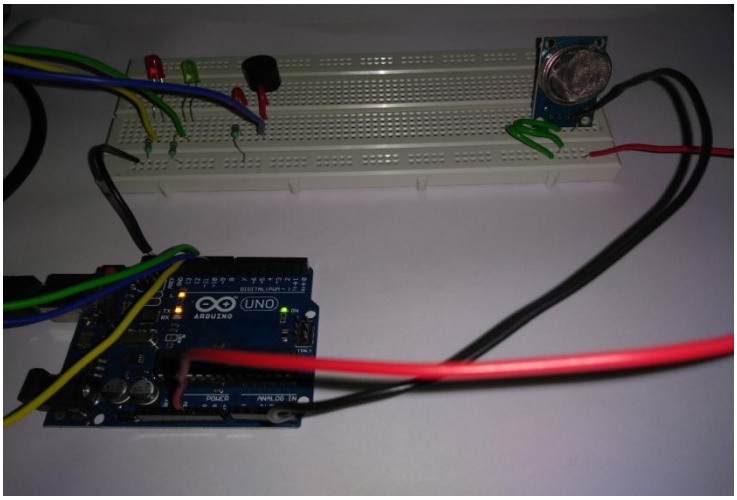


Fig 6.1 Figure Showing No gas detected

When the Smoke is brought near the MQ2 gas sensor Chemical reactions in the gas sensor send variable voltages to the Arduino and depending upon the parameters set in the source code the schematics in the computer program shows the gas value with the message “GAS DETECTED” the same is displayed on the LCD along with the value of LPG, CO2 and smoke in ppm. The same is showed below in the fig.

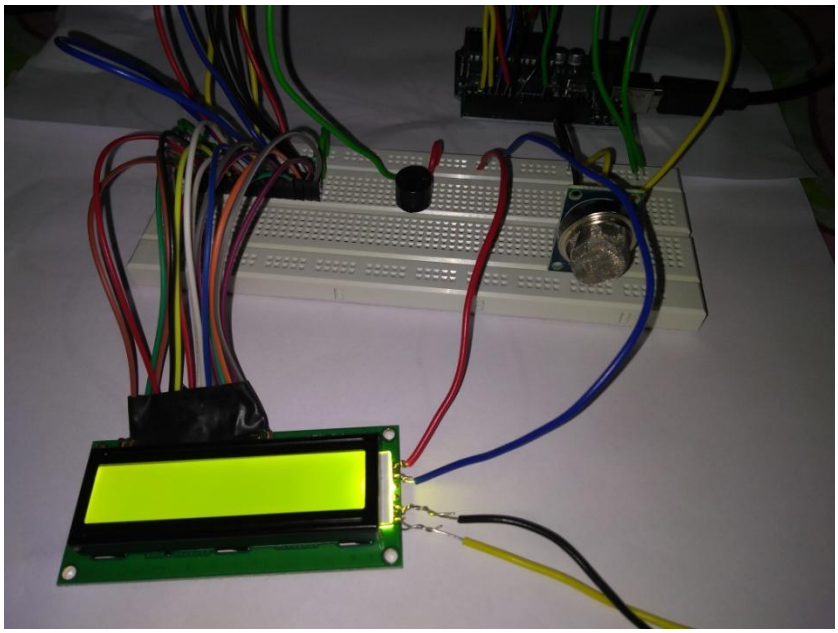


Fig 6.2 Figure showing Gas Detection.

CHAPTER 7

SCOPE FOR FUTURE

Since the device is portable, theoretically further developments can be made to develop the same in miniature sizes so that it can be installed in small bikes to huge trucks, linked directly to the exhaust manifold with an LCD display at the front of the driver's seat with proper indication devices without creating much space constraints. The driver can always be updated about his/her vehicle emission status. This can somewhat help to control air pollution to the certain extent. By these the owner need not to pay a visit to any emission centres nearby which most of the vehicle owners never do. Our Project focuses on price constraints, so every vehicle holder can buy these.

CHAPTER 8

CONCLUSION

The use of portable emission gas analyzer can help reduce the pollution causing agents like NOx(NO-Nitric Oxide,NO2-Nitrogen dioxide,N2O-Nitrous oxide), Carbon Monoxide (CO), Carbon dioxide (CO2), unburnt hydrocarbon residues that are being released into human environment. They tend to damage the insides of an engine like combustion chamber walls, piston, valves, as they tend to deposit on them, hence these pollutants should be kept away from formation at any costs. The aim of this project helps visualize that by developing a detector device that can do the detection work efficiently keeping the cost of it to minimum when compared to other devices that are available in the current market. By doing so, everyone now can have his/her own emission analyzer that they can carry around or use whenever they feel like doing so. This ultimately sums up to notion that they are now able to maintain and keep the pollutants coming out of their vehicles in check and maybe they can choose between the fuel the next time based on the emission report.

BIBLIOGRAPHY

[1] Qi Wang, Kai Song, Tiandong Guo "Portable Vehicular Electronic Nose System for Detection of Automobile Exhaust" in Harbin China.

[2] F.A.A. Matias and M. Tubino "A Portable Fibre- Optic Chemical device for the Quantitative determination of carbon monoxide from automobile exhaust emission".ISSN: 1096-2247 By Taylor and Francis 27 Dec 2011.

[3] J.C Neerman, J.L. Parsons and F.R. Bryan, "A Continous Flow Method of determining unburned fuel in automotive Exhaust" ISSN: 0002-2470 By Taylor and Francis 19 Mar 2012.

[4]S.Bonda,S. Mohanty and S.Kumar Nayak, "Analysis of exhaust gas emission in diesel engine operating with diesel and bio diesel blends" 15 Aug 2014.

[5] J.L.Jones, E.A Sckuck, R.W Eldridge, N Endow and F.W Cranz, "Measurements of Automobile exhaust Gas Hydrocarbons. ISSN: 0002-2470 by Taylor and Francis 19 Mar 2012.