ISSN No:-2456-2165

Bio-Gas Range Indicator in a Vehicle Fuel Tank

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Abstract:- Today's vehicles include an analog or digital meter that displays the level of fuel in the vehicle using an analog meter or digitally in the form of points or levels. It can be challenging to determine the exact amount of fuel in the tank. When the fuel level hits the reserve point, the meter's point begins to flicker. It is challenging to estimate how far the fuel can take the vehicle. Making a biogas level indicator that displays the amount of biogas in the fuel tank is the goal of this project. Along with the level, it also shows how many kilometers (km) of biogas are still in the tank. Every bike's mileage varies depending on the engine and the rate of combustion. We must figure out the bike's mileage and use it as a benchmark in order to display the biogas tank's range (in kilometers). Now we will utilize the sensors (gas pressure sensor for gases) to check the fuel tank level. We picked biogas as the fuel for the project because it is a renewable energy source. Petroleum is a fossil fuel that could eventually run out. Lithium-powered batteries are used in electric vehicles. A natural resource called lithium can eventually run out. However, biogas is produced from organic waste, which will always exist. We employ liquefied biogas (LBG) as a fuel because it is more than 600 times space efficient than biogas at atmospheric pressure, or around 3 times more space efficient than Bio-CNG.

Keywords:- *Bio-Gas, Sensor, Microcontroller, LBG, Range, Kilometers, Pressure, Renewable Energy***.**

I. INTRODUCTION

A fuel level indicator is an essential component in many vehicles and machinery, acting as a fundamental link between users and their awareness of fuel consumption and tank levels. Whether you are driving a car, running heavy machinery, or flying an airplane, knowing how much fuel remaining in your tank is critical for efficient and safe operation. This simple but vital device offers real-time information on the quantity of fuel available, allowing users to plan their routes, monitor fuel efficiency, and avoid running out of fuel suddenly. This lecture will delve into the operation, varieties, and importance of fuel level indicators, illuminating the critical function they perform in contemporary transportation and industry. Whether you are a vehicle enthusiast, an engineer, or simply curious about the technology that keeps your car running smoothly, this exploration of fuel level indicators will provide valuable insights into a fundamental aspect of modern transportation and machinery.

- *Abbreviations and Acronyms*

- LBG – Liquefied Bio Gas

- *Units*

- Km - kilometers

II. LITERATURE SURVEY

A sophisticated fuel monitoring system uses a pressure sensor beneath the fuel tank to properly assess fuel levels, especially while refueling. Digital screens display real-time data. The system employs GPS and GSM to send gasoline level and location information to the owner's mobile device through SMS, allowing for precise fuel use tracking[1]. This project remotely checks gasoline levels using a sensor attached to a microcontroller and displays data on a website. It also detects fuel theft by establishing a threshold for decreasing fuel rates and activating alarms accordingly[2]. IIT Delhi's Biogas Forum India is a venue for the promotion of environmentally friendly biogas solutions. For clean energy and environmental sustainability in India, it encourages discussions, research, and innovation[3]. Fuel pump fraud is becoming more prevalent, since altered pumps display bogus readings. A "Digital Fuel Meter" is being created to provide precise fuel quantity readings and increase customer transparency as a means of combating this[4]. Using an Arduino, flow meter, ultrasonic sensor, and RS-485 connection, the project manages and monitors the state of power generators, fuel usage, and efficiency. Remote data access improves accuracy and safety over manual approaches, which benefits a variety of sectors and projects[5]. In order to provide accurate tracking, gasoline monitoring systems use pressure sensors, GPS, and GSM.

The Biogas Forum at IIT Delhi advocates for green biogas technologies. By providing reliable readings, a "Digital Fuel Meter" fights pump fraud. An Arduino-based project improves generator monitoring and fuel management by allowing remote access.

III. FUEL LEVEL INDICATOR

In order to give drivers information about how much petrol is still in the tank, fuel level indicators are a crucial part of all cars. It is essential in assisting drivers to control their gasoline usage, schedule fuel stops, and prevent unplanned fuel runs.

Usually, fuel level indicators are shown on the dashboard of the car, frequently with the aid of a gauge or digital readout. The indicator is coupled to a sensor within the fuel tank that measures the real gasoline level. This sensor may use float-based systems, ultrasonic sensors, or resistive sensors, among other technologies[1].

The fuel level indicator not only lets drivers know how much petrol is left, but it also enables them to calculate how much further they can go based on how fuel-efficient their car is[5]. It aids drivers in making knowledgeable choices about when and where to refill, which promotes convenience, safety, and effective fuel management.

In newer automobiles, gasoline level indicators may also contain low petrol alerts, distance-to-empty predictions, and integration with navigation systems or smartphone apps. These advances provide a more comprehensive view of fuel condition and improve the driving experience overall.

IV. BIO GAS LEVEL INDICATOR

A biogas range indicator for vehicles that uses an Arduino microcontroller and a HX710B pressure sensor is a novel and environmentally responsible solution for monitoring and showing fuel levels in kilometers. This technology makes use of renewable energy sources, giving it an eco-friendly option for contemporary transportation.

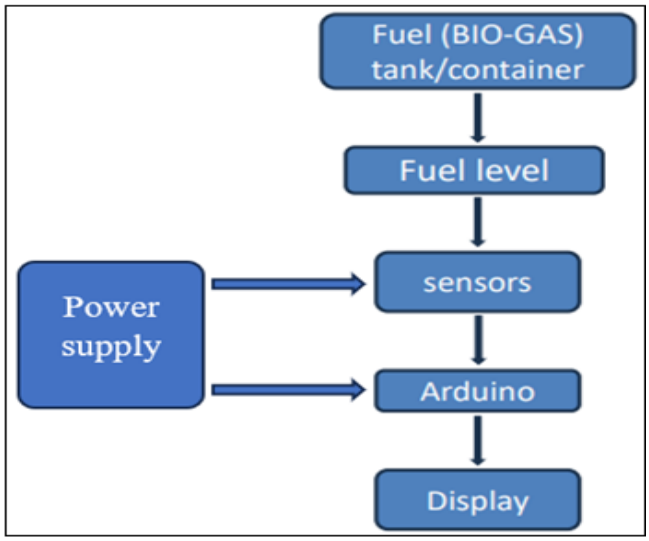

Fig 1 Block Diagram of Bio-Gas Range Indicator

➢ *Bio-Gas:*

Organic waste products including agricultural wastes, animal dung, and sewage are converted into biogas, a renewable and environmentally benign fuel[3]. These organic materials undergo a process known as anaerobic digestion when microorganisms break them down, yielding biogas mostly made of methane and carbon dioxide[3]. As a sustainable energy source that lowers greenhouse gas emissions, eases waste disposal issues, and promotes energy independence, biogas is incredibly important. It can be used as fuel for vehicles as well as for heating, cooking, and producing power. Utilizing resources more effectively, promoting sustainable agricultural and waste management techniques, and cleaning up the environment are all made possible by biogas[3].

➢ *Components:*

- *Arduino UNO Microcontroller:*

The brain that analyzes sensor data and determines the range of biogas in kilometers is the Arduino microcontroller, which is at the center of this system[8]. The adaptability and programmability of Arduino make it the perfect choice for this application.

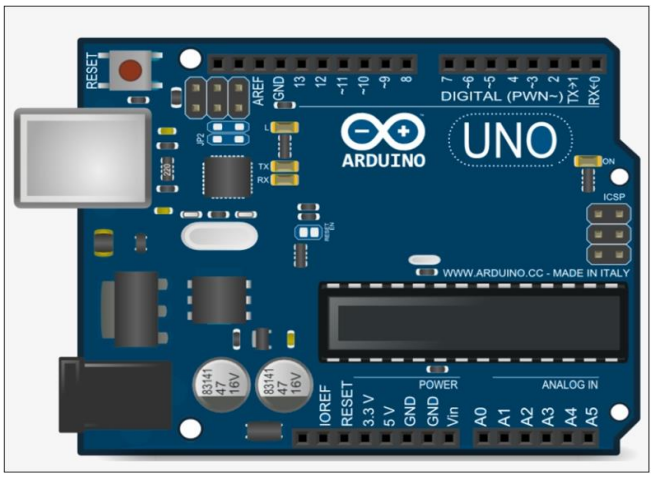

Fig 2 Arduino UNO

- *HX710B Pressure Sensor:*

The HX710B pressure sensor is used to gauge the pressure of biogas in a vehicle's fuel tank. Changes in pressure are a sign that the fuel level has changed. The HX710B is renowned for its precision and dependability, which makes it appropriate for this crucial work.

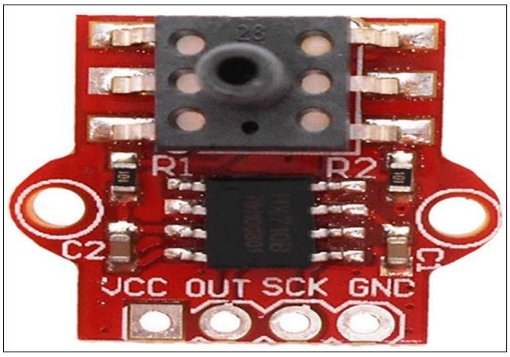

Fig 3 HX710B Air Pressure Sensor

- *16X2 LCD Display:*

A 16x2 LCD display is crucial to a biogas level indicator because it offers a user-friendly interface for showing important information [1]. In the context of a biogas level indicator, it displays the calculated range of fuel in kilometers, allowing drivers to quickly check their fuel status. It is an effective tool for delivering real-time data, boosting effective fuel management, and improving the overall driving experience thanks to its compact size and clear text.

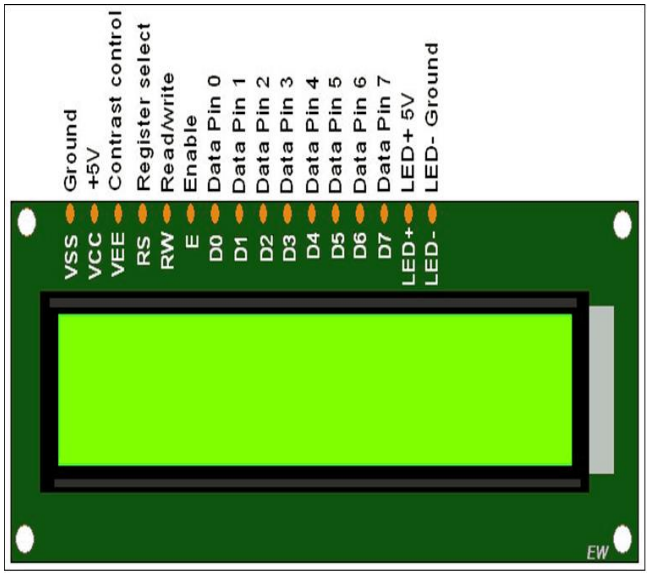

Fig 4 16x2 LCD Display

➢ *Working:*

- *Sensor Integration:*

The HX710B pressure sensor is safely mounted inside the car's gasoline tank. It continuously monitors biogas pressure, which is correlated with fuel level.

- *Data Processing:*

The Arduino microcontroller transforms pressure readings from sensors into useful units (such as liters or gallons of biogas). It also takes into account parameters such as temperature and atmospheric pressure to provide accurate readings.

- *Range Calculation:*

Using the data gathered, the Arduino determines the vehicle's remaining range in kilometers based on the biogas consumption rate. It considers elements like the performance of the engine and the road.

- *Display:*

The calculated range is then shown to the driver on an easy-to-use interface, usually an LCD screen on the dashboard of the car. This indicator shows how far the car can travel with the current biogas level in real time.

- *Alarms and Warnings:*

The system can incorporate features like low fuel alarms, which advise the driver when the biogas level is critically low and refuelling is required.

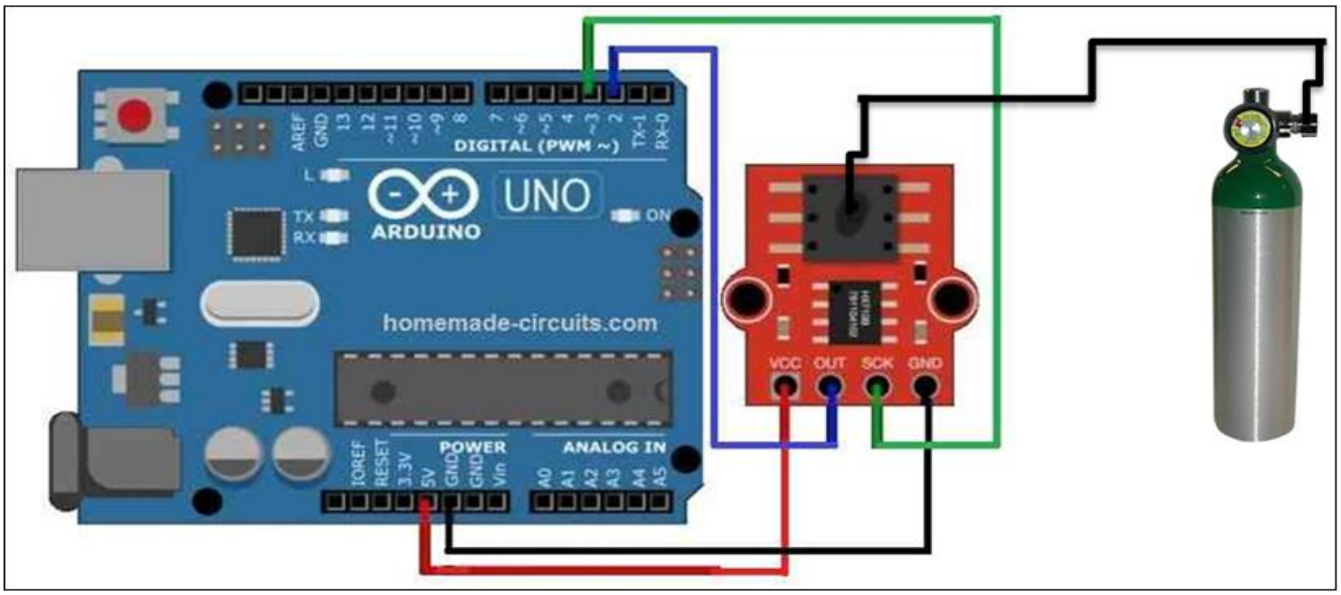

Fig 5 Bio Gas Range Indicator Circuit

In the IDE, you write code that reads biogas data from sensors, calculates the range in kilometers based on consumption rates, and displays it. The code is then uploaded to the Arduino board using a USB connection after being written. The indicator should then be tested to ensure that it appropriately displays the biogas range on the intended output, which is usually an LCD screen, giving consumers real-time information about their vehicle's fuel status in kilometers.

➢ *Formula:*

The fuel range (in kilometers) of a vehicle with remaining fuel in the tank is calculated using gas pressure, vehicle mileage, and combustion rate. Based on the idea that when gas is burned, the pressure lowers according to the amount burned, we may estimate the range that is still available. The formula takes into account the pressure change per gram of gas burned to determine how far the car can go on the remaining gasoline.

Kilometers = (pressure from hx710b) * (mileage) * (combustion rate)

For this model we have considered the vehicle with

Mileage = 40kmpl

Combustion rate = 0.4gm/sec

Speed of the vehicle is considered to be 20kmph for this model and pressure of gas from pressure sensor is given to the Arduino.

➢ *Code:*

```
#include "HX711.h"
#define calibration_factor 70500000.0
#define DOUT  3
#define CLK  2
HX711 scale;
void setup() {
  Serial.begin(9600);
  Serial.println("HX711 scale demo");
  scale.begin(DOUT, CLK);
  scale.set_scale(calibration_factor
  scale.tare();
  Serial.println("Readings:");
}
void loop() {
  Serial.print("RANGE OF FUEL: ");
  Serial.print(scale.get_units() * 0.4 * 40, 1);
  Serial.print(" km");
  Serial.println();
  delay(200);
}
```

➢ *Explanation of Code:*

The included Arduino code connects to a HX711 load cell amplifier to determine and present a fuel range in kilometers. It configures the HX711 module with the appropriate data, clock, and calibration pins. In the loop, the load cell data is continually read, converted to kilograms, multiplied by 0.4 (a scaling factor), and then multiplied by 40 (to convert to kilometers) before the fuel range is displayed on the serial monitor with one decimal place accuracy. Every 200 milliseconds, the code automatically changes the reading. In order to get correct readings, it is assumed that the load cell, which detects fuel level, has been calibrated with the required factor.

The pressure sensor HX710B's interface with Arduino applications is made simpler by the HX711 library. It provides tools for calibrating, reading measurements, and initializing the sensor. This library improves precision in load cell and pressure sensor applications, allowing developers to integrate the HX710B sensor into their projects more easily. The HX711 library simplifies the collection and processing of sensor information by providing a standardized user interface, enabling precise and effective measurement along with information analysis.

➢ *Output:*

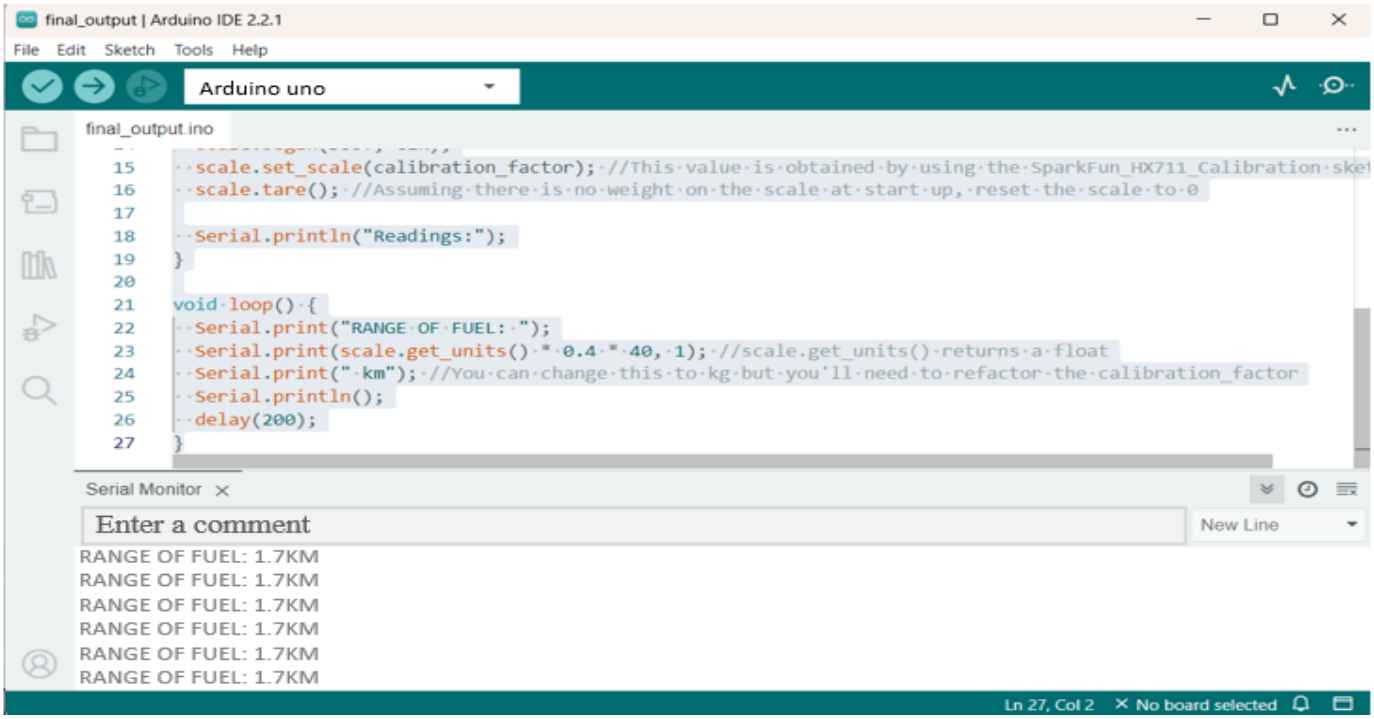

Fig 6 Output on Serial Monitor

Table 1 Observations from the Working Model

WEIGHT OF GAS IN THE CONTAINER	PRESSURE FROM HX710B (N/m2)	RANGE OF THE FUEL (KM)
100g	0.31	4.96km
80g	0.248	3.96km
70g	0.217	3.47km
55g	0.170	2.72km
34g	0.105	1.68km
30g	0.093	1.49km

The device has successfully estimated the fuel's range in kilometers, as requested. The default baud rate is 9600. This indicates that 9600 bits are sent each second. The output in the serial monitor is seen in the image above. The weight of gas in its container was 34grams, the pressure was 0.105N/m2, the vehicle mileage being 40kmpl, and the engine's combustion rate is 0.4gm/s.

The bio gas cylinder (fuel container) has been linked to the HX710B pressure sensor valve. The HX710B pressure sensor is made up of a diaphragm that is located inside the valve. The diaphragm comes into contact with the pressure and is struck by it as soon as the force is applied on the sensor, i.e., the opening or input of the sensor. The hx710b IC recognizes this information and transmit this information to the Arduino uno micro controller board.

The Arduino uno microcontroller board reads this digital input data from the hx710b pressure sensor through digital input output pins 2 and 3, which are coupled to the pressure sensor by SDA (serial data line) and SCK(serial clock). The microcontroller board is reading this data, implying it in the code, which then uses it to calculate all the requirements and output the results.

V. CONCLUSION

The fuel range (in kilometers) of a vehicle with remaining fuel in the tank is calculated using gas pressure, vehicle mileage, and combustion rate. Based on the idea that when gas is burned, the pressure lowers according to the amount burned, we may estimate the range that is still available. The formula takes into account the pressure change per gram of gas burned to determine how far the car can go on the remaining gasoline.

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