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Digital Fuel Meter

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ABSTRACT:
Rapidly increasing frauds at petrol pump and cheating of petrol and diesel while providing it to the customers have become a major problem these days. Devising of a Digital Fuel Meter, which would accurately measure the amount of fuel entering the fuel tank may be a solution to these problems.
Inbuilt Digital Fuel Meter has many advantages that will be proved beneficial for the daily customers as well as providers, developing the country as a whole.
The main aim behind the introduction of the digital fuel meter is measuring the exact volume flow rate of the fuel, reducing the frauds. The conventional Fuel Gauge measures the amount of fuel present in the tank, in spite of measuring the exact content of fuel entering. Therefore, the Digital Fuel Meter will play an important role in providing the customers, the exact volume flow rate of the fuel entering the tank. Various challenges faced in the designing of the same have been mentioned in the research paper, along with the incorporation of suitable material to the new design of the meter.
KEYWORDS: Digital fuel meter, polypropylene material, Oil and Oxygen absorber

I. INTRODUCTION

Petrol pumps have become a hub for cheating tricks, frauds and scams. Due to sudden increase in the prices of petrol and diesel, the hardships faced by the common people have reached its peak. In these chaotic times, it is of utmost importance for every person, ranging from an average middleclass employee to well established businessman, to act in a smart and attentive manner in the fields where there are chances of being cheated by others. The Digital Fuel Meter can be proved as an effective device in the field of transportation and Automotive Industries, which claims themselves to be user centric. It will not only prohibit fuel cheating, but will also bring a sense of satisfaction to consumer.

II. OBJECTIVE

The main purpose of this project is to make a device which will display the exact amount of fuel which is entering in the fuel tank through fuel nozzle at the time of refuelling in petrol pump(gas station).

III.COMPONENTS

The device comprises of three main components.

1. Flow Rate Sensor

It acts as a fuel input deviceto our system as the fuel goes through its inlet and after that to the fuel tank of the vehicle. The flow rate sensor consists of mainly four parts

- Casing
- Cylindrical hollow magnet
- Rotating fan
- Long shaft

Hall Effect: flow rate sensor is based on the principle of hall effect which states that:

Working: Flow sensor consists of a plastic valve from which water can pass. A rotor along with a hall effect sensor is present the sense and measure the flow.

When fuel flows through the valve it rotates the rotor. By this, the change can be observed in the speed of the rotor. Thus, the rate of flow of fuel can be measured.

The main working principle behind the working of this sensor is the Hall Effect. According to this principle, in this sensor, a voltage difference is induced in the conductor due to the rotation of the rotor. This induced voltage difference is transverse to the electric current.

When the moving fan is rotated due to the flow of fuel, it rotates the rotor which induces the voltage. This induced voltage is measured by the Hall Effect sensor and displayed on the LCD display.

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2. Arduino UNO Board

It is the second and the most important element of the model as it acts as minicomputer to our system and calibrates the signal from the flow rate sensor and feed the output to the display board.

It also acts as an intermediate between the flow rate sensor and the display board. The piezoelectric control-based pilot allows for direct regulation of other engine valve parameters including variable lift and seating velocity. The output from the Arduino board act as the input of the display board as Arduino board calibrates the signal and gives us the result in numerical values on the display board.

3. Display Board

A board which or we can say a device which shows the output i.e. the reading.

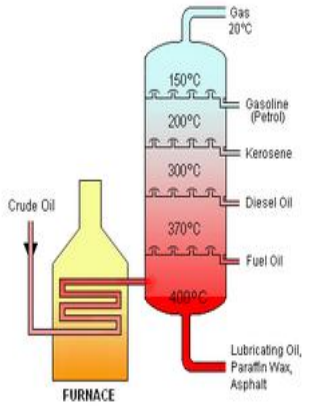
The amount of fuel in the tank is shown in the display board in numeric / numbers; therefore, we can get the accurate amount of fuel in our fuel tank.

IV. FUEL & THEIR PROPERTIES

PETROLEUM

Introduction: -

- Petroleum is yellowish black liquid which is found below the earth surface.
- Petroleum has various components which are separated by a process called **"Fractional Distillation"**
- Fractional Distillation is the process of separating components which differ in boiling point by using a fractionating column.



PETROL: -

- Gasoline also known as petrol is a petroleum derived liquid that is used as a fuel in most Spark-ignited Internal combustion engines.
- Petrol is a highly flammable liquid and can enter the environment in both vapor as well as in liquid form.

Properties of Petrol: -

- Density of petrol is 0.742kg/m^3
- Boiling point at 1 atm pressure is 25-215 ºC
- Flash point at 1 atm pressure is -40ºC
- Auto-ignition temperature is 280ºC
- The Specific Gravity of petrol is from 0.71 to 0.77
- Octane Number (RON) of petrol is 90

Diesel: -

- Diesel is a liquid fuel which is used diesel engines
- Diesel engines have high thermodynamic efficiency and also high fuel efficiency as a result of which diesel engines are broadly used.

Properties of Diesel: -

- Density of petrol is 0.85kg/m^3
- Boiling point at 1 atm pressure is 150-380ºC
- Flash point at 1 atm pressure is 52ºC
- Auto-ignition temperature is 210ºC
- The specific gravity of diesel is from 0.82 to 0.95
- Cetane number (CN) of diesel is 48.5

V.IDEA GENERATION AND RESEARCH ON DESIGNING OF NEW MODEL

The model of the existing flow rate sensor had many drawbacks to be compatible with petrol as a fluid in use, the main being interference of the magnetic field lines with the fuel flow and the danger of blast and leakage of current through the circuit**.**

Reason for Excluding Existing Flow Rate Sensor

The existing design of the flow rate sensor had magnet attached at the very end of the rotor blades and the sensor being next to it, to convert the fluctuating magnetic flux to electronic impulse. The fuel here used is highly flammable and explosive in nature, a slight chance of leakage of current or high magnitude of magnetic waves is life threatening.

An approach has been made to create the same phenomenon (Hall Effect) by distancing the position of the sensor from the fluid flow by elongating the existing smaller shaft and creating hindrance in the path of the fluid vapours by using the absorbent I.e. Polypropylene pads.

VI. OIL ABSORBENT

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The material used as oil absorbent is Polypropylene pad. It actually is fine strands of plastics, which are formed together in layers to create a thin pad like structure.

Polypropylene (thermoplastic addition polymer) material is heated until it reaches a liquid form and its conversion into a liquid it is then sprayed through a manifold system, creating thin strings of plastic, then it is layered the proper thickness is reached and at last they are cut into the desired shape.

Advantages:
1. Readily available and inexpensive.
2. Insulation: very highly resistant to electricity.

VII. OXYGEN ABSORBER

In order to address the major risk of catching fire inside the device due to the presence of flammable fuels like petrol and diesel and also the electric sparks near the battery and sensor unit, we incorporated an absorber, which is a cobalt-based oxygen absorber which has a crystalline structure (Crystalline salts of a series of cationic multi-metallic cobalt complexes).

It absorbs oxygen present inside the device in a selective chemisorptive process. Cobalt which is the key component of this material is bound in a specially designed organic molecule. The crystals here undergo the process of reversible single-crystal-to-single-crystal (SC-to-SC) transformation on the stoichiometric uptake of O2 atom. Then this O2 atom replaces the two nitrate ligands.

This cobalt based oxygen absorber is a sensor and also a container for oxygen as we can even use the material to bind, store and transport oxygen. The material is readily effective in binding the oxygen present in the environment, that even a spoon of it is more than enough for sucking up all the oxygen present in the room.

It has been found that the substance can easily absorb oxygen even in a concentration of about 160 times larger than the concentration of the air around us. It can absorb and release oxygen a lot of time without losing its ability to absorb.

VIII. SOURCE CODE FOR THE MICROPROCESSOR:

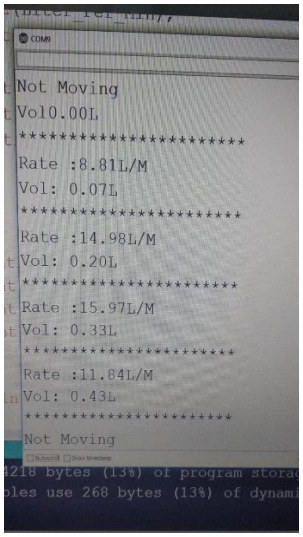
```
int X;
int Y;
float TIME = 0;
float FREQUENCY = 0;
float Liter_In_Period = 0;
float Liter_Per_Min = 0;
float Total = 0;
const int input = A3;
void setup()
{
Serial.begin(9600);
pinMode(input,INPUT);
}
void loop()
{
X = pulseIn(input, HIGH );
Y = pulseIn(input, LOW );
TIME = X + Y;
Serial.println(TIME);

FREQUENCY = 1000000/TIME;
Liter_Per_Min = FREQUENCY/7.5;
Liter_In_Period = (Liter_Per_Min/60);// the period is 1/2 sec for which we are assuming the flow rate is constant
if(isinf(FREQUENCY) != 1 &&Liter_Per_Min>0 )
{
  Total += Liter_In_Period;
  Serial.print("Rate:");
Serial.print(Liter_Per_Min);
Serial.println("L/M");

Serial.print("Vol: ");
Serial.print(Total);
Serial.println("L");

}
Else
```

OUTPUT



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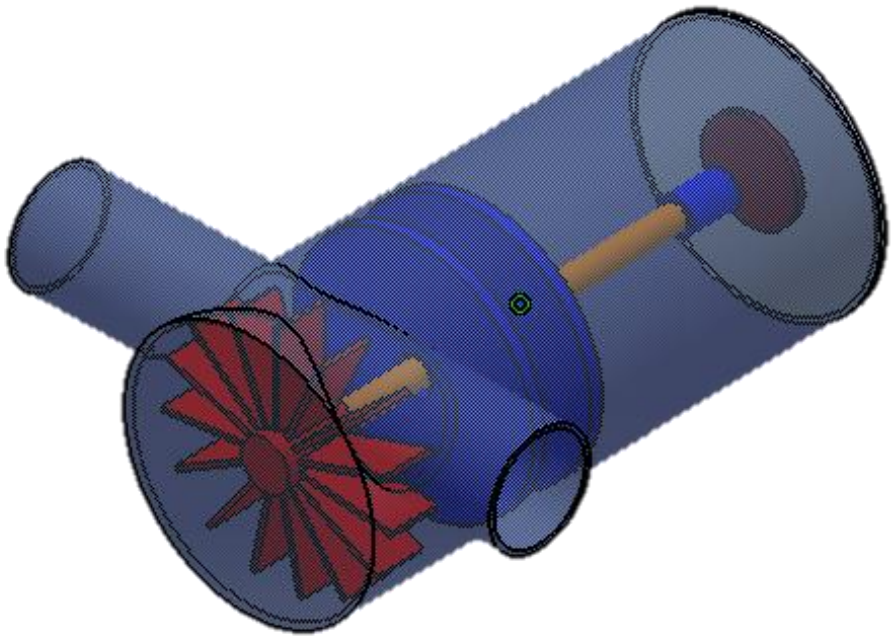
X.IMPROVISED DESIGN WITH INCORPORATED ABSORBENT MATERIALS



MODIFIED DESIGN SPECIFICATION

1.The modified design consists of a much-elongated shaft than the existing, encompassed inside a protruding cylindrical case to support the shaft and sensor.

2.The absorbent pads are to be mounted at the inner lining of the cylindrical casing, in the shape of circular pads, and also a gap of about 2-3 mm is provided in between the pads and the rotating shaft so that there is no hindrance in the movement (rotation) of the shaft.

3.Also, not only 1 but 2-3 layers of these absorbent pads are to be placed so that if some vapours are missed by the first, can be absorbed by the others so that there are negligible (approx. 0) chances of the vapour to reach the sensor/circuit.

4.The end of the shaft consists of a hollow cylindrical magnet of suitable thickness in order to create the fluctuating magnetic field.

5. The end of the casing is incorporated with a safe space to procure the sensor and the wirings tore cord and send the signals further to Arduino.

6. The front protruding end of the shaft that supports the rotor is extended further to meet the casing in a hole like structure to provide the necessary support and sustain the thrust force of the high velocity fluid entering the gauge.

7. The inner lining of the cylinder and the blades of the rotor are all coated with a thin layer of polypropylene material to resist impact loading and capture the vapours of the fuel effectively.

XI.CONCLUSION

With the modified Digital Fuel Meter, the customers will get the exact amount of fuel which they paid as an exact amount of the fuel entering will be measured by the meter. This will help overcome the economic and social barriers as well which lacks due to fuel cheating and frauds. And this will result in an overall growth of the country, with the reduction in taxes, and a great sense of relief for the common man in paying an unnecessary amount and getting cheated.

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