Digital Petrol Indicator using Load Cell

Miss. Aishwarya Dudhe[1] Miss. Suhani Bhandarkar[2] Miss. Gayatri Mohod[3]
Mr. Chandrashekhar Bure[4] Prof. Vivek Raut[5]
[1,2,3,4]Student [5]Professor
[1,2,3,4,5]Department of Electronics & Telecommunication Engineering
[1,2,3,4,5]Meghe Institute of Technology & Research, Badnera, India

Abstract— The utilization of vehicles is rapidly increasing now a days and it leads to a huge problem of fuel availability. Often humans forgot to check the fuel level before Taking vehicles and it will run out of fuel in half a way. All petrol and diesel filling bikes have analog displays to indicate the amount of fuel added. The users don't know whether it is showing the accurate value or not. In addition, Petrol pump frauds are very common now days. Many of the petrol pumps today temper the pumps such that it displays the amount as entered, but in actual, the quantity of fuel filled in the consumer's tank is much lesser than the displayed value. The pumps are cheating for the profit of the petrol pump owner. This results in great profits for the petrol pumps, but at the same time the petrol consumers are being cheated. To overcome this problem, this project suggests a load cell based fuel measurement system which gives almost exact level of fuel while fuel filling process and also in the travelling time. Nonstop monitoring of fuel level is attained by attaching the load cell below the fuel tank with the use of Arduino Uno and display unit fixed with dash board. The measured fuel levels can be sent through GSM module to the owners of the hiring vehicles by messages through electronic gadgets for their verification purposes. In today's modern and digital world, if the fuel indicator in the vehicles is made digital, then it will help us to know the almost exact amount of fuel available/filled in the tank. The above fact is considered in our project. The almost exact amount of fuel available in the tank will be displayed digitally by making the use of Load Cell. This project mainly concentrates on the digital indication of fuel in vehicle's tank.

Key words: Digital Petrol Indicator, Load Cell

I. OVERVIEW

A. Problem Statement

To design a fuel metering that can report the almost exact amount of fuel in the tank. The amount should be reported in a digital readout and should be in unit of either litres and in kms at average/current consumption.

B. Motivation

Since petrol pump frauds are very common now days, many of the petrol pumps today temper the pumps such that it displays the amount as entered, but in actual, the quantity of fuel filled in the consumer's tank is much lesser than the displayed value. The pumps are cheating for the profit of the petrol pump owner. This results in great profits for the petrol pumps, but at the same time the petrol consumers are being cheated. Most of the two wheelers vehicle in India has analog meters for the measurement of fuel level which is not that much almost exact, so it is not possible to measure almost exact amount of fuel inlet. As we have studied this further topic and contacted some bike owners and showrooms, it came to know that petrol can be measured digitally by using float sensor but it does not show the almost exact amount of fuel in fuel tank. In four wheelers, digital indication is used but it shows some range and not the almost exact amount but whereas in two wheeler it is yet to come.

So we have proposed this idea consisting of a digital display for the almost exact volume of fuel contained in the fuel tank.

C. Aim

A digital display of the almost exact amount of fuel is contained in the vehicle's tank. To achieve this goal, the value of fuel which is in litres will be in numerical digits (ex: 1.2 lit, 1.3 lit, 1.4 lit). This project mainly concentrates about the indication of fuel level in two- wheeler tanks. The aim is to create cross checking the quantity of fuel filled at the petrol theft.

The system has to show the almost exact amount of fuel in the fuel tank as compared to the previously used gauge meters in which a needle moves to give rough estimate of the fuel in the tank.

II. LITERATURE REVIEW

In this chapter literature review of Digital Fuel indicator with background study and Objective and scope of the project is explained.

A. Literature Review

1) Existing Technology:

Most of the vehicles in India consist of analog meters hence it is not possible to precisely know the amount of fuel currently in the vehicle and also it is not possible to cross check the quantity of fuel filled in the petrol bunk. The traditional fuel indicator consists of two units i.e. the sending unit and the gauge. The Fig 3 shows the commonly used traditional fuel measurement system. The sending unit is located in the fuel tank of the car and it consists of a float, usually made of foam, connected to a thin, metal rod. The end of the metal rod is mounted on a variable resister or potentiometer.

The variable resistor consists of a strip of resistive material over it which moves across the variable resistor changing the resistance and flow of current depending on the movement of the float with respect to the level of fuel present in the fuel tank. The below Fig shows that the fuel in the fuel tank is almost empty and the float has moved to the bottom of the tank moving the strip on the resistor thus increasing the resistance to maximum and current flow through the resistor becomes minimum thus displaying fuel empty on the gauge.

The gauge consists of a bimetallic strip i.e. a strip made of different kinds of metal and whose thermal coefficient of expansion differs from each other. When resistance is decreases current increases and thus the strip is

heated during which one metal expands less than the other, so the strip curves and this bending action is what moves the needle move on the fuel gauge. As resistance increases, less current passes through the heating coil, so the bimetallic strip cools. As the strip cools, it straightens out, pulling the gauge from full to empty.

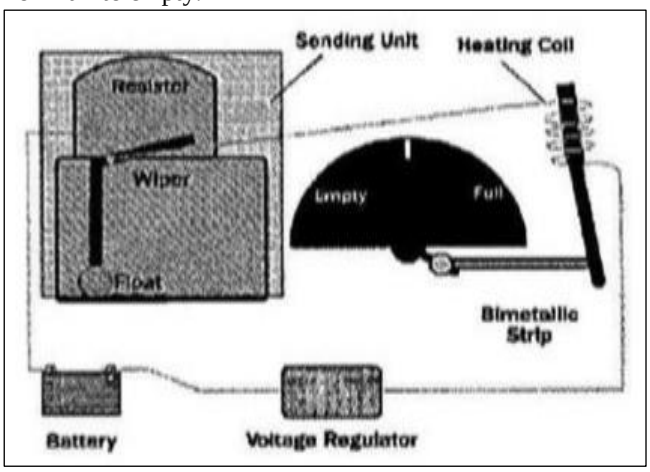


Fig. : Traditional Fuel measurement system

The smart fuel gauge system techniques has been implemented in some newer cars in which, instead of sending the current directly to the gauge, an intermediate microprocessor is used to read the output of the resistor and then communicate with the dashboard for displaying the fuel on the gauge corresponding to read output voltage from sending unit and these system actually help to improve accuracy of system.

Thus by this project scheme, it will be easy to focus on new technologies which will result into showing almost exact value and displaying in easiest way.

B. Objective

The vision behind this project is to put forth a practical, commercially feasible and easily implementable digital fuel indicating system. The system can be better understood by judging the software and hardware modules on their individual merits and their performance on conjunction with each other.

- Creating a Digital Fuel Indicator, to measure the almost exact amount of fuel in the tank and display it.
- Monitoring of fuel theft and leakage, and to bring it to the notice of the owner.

III. PROPOSED SCHEME

In this Chapter the detailed study of the System Overview containing Proposed Scheme, System Flow, Algorithms and the System Architecture is explained with the basics concepts of the system

A. Proposed Scheme

This project focuses on creating a device which can help to actively display the almost exact amount of fuel in real time. It involves the making of the system to provide an indicator which is reliable, easy to read and of dependable/compatible overall design. The system comprises of Fuel tank, Load cell, Battery, Arduino Uno with LCD display.

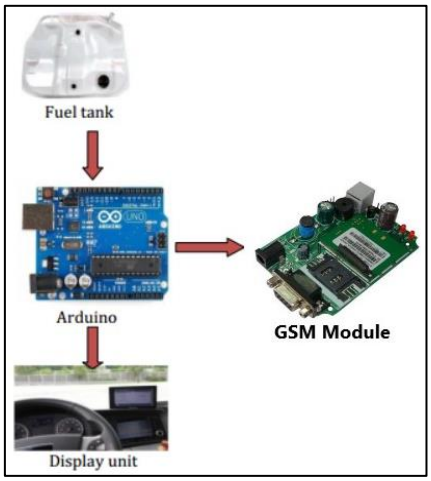


Fig. : Principle Concept of Fuel indicator

B. System Flow

The overview of a complete process is explained with the help of the following flow chart.

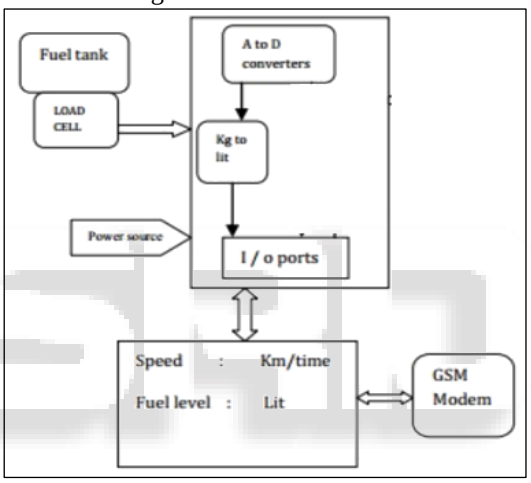


Fig. : Overview of System Flow

IV. SCHEMATIC DIAGRAM

Schematic and working of the project is explained in this chapter which gives the description of the connections of module with Arduino and the actual working of the project.

A. Schematic

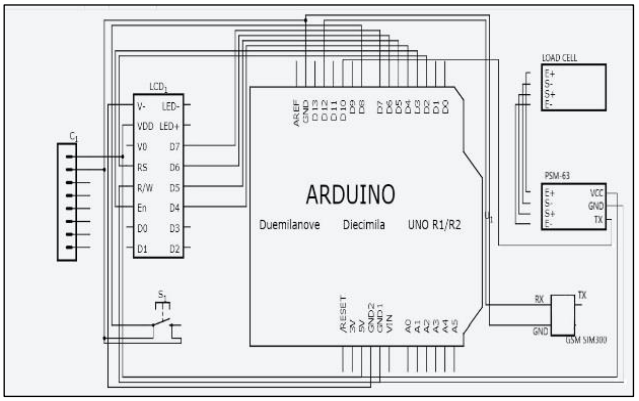
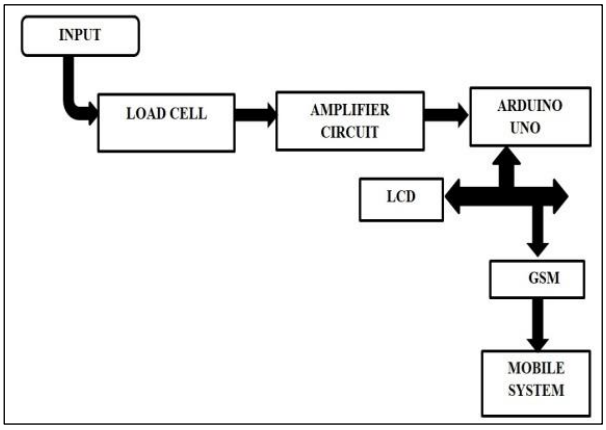


Fig. : Schematic Diagram of System

B. Block diagram And Working:

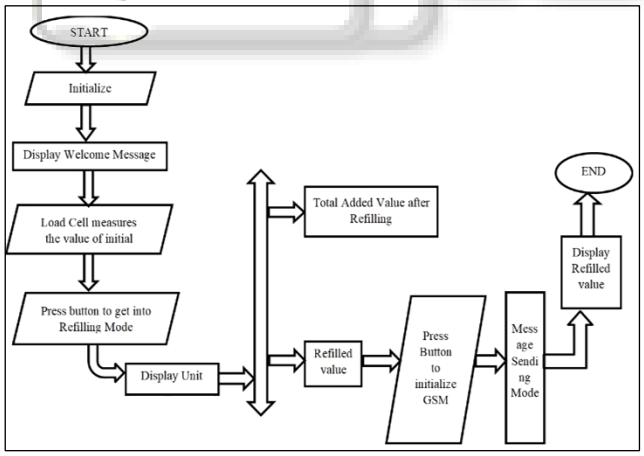


As shown in the Block Diagram, the Load cell measures the weight of petrol present in the tank. The Analog output of load cell is sent to the Amplifier Circuit PSM-63 used. This circuit converts the analog output into digital form with the help of Analog to Digital converter which is inbuilt in it. This digital data is then sent serially to ARDUINO-UNO at PIN no. 10 as shown in Schematic. The Output of Arduino is then displayed on LCD using corresponding PINs i.e. D4-D7.

Initially, as the tank is placed on load cell, it measures the weight of petrol which is present in tank. Using Switch button, the system will get into Fuel refilling mode after it reaches to Fuel filling station. Now the LCD display will show the total added value along with the refilled value as the petrol gets filled.

Once the refilling is done, LCD screen will display the refilled value only. Using GSM system, the message of refilled value along with payment is sent to the owner.

V. FLOW CHART



VI. CALCULATION

Calculation of fuel level depends on the fuel density. The density of the fuel is commonly expressed in kilograms per cubic meter. Hence greater the fuel density, the greater the mass of fuel and the greater the mass of fuel than can be pumped for a given pump. Fuel density commonly increases with increasing molecular weight of the fuel and energy density values are tabulated as shown in the table 1. Fuel density also generally increases with increasing molecular weight of the component atoms of the fuel molecules. Fuel density is used to calculate fuel volume ratio, which is in turn used to calculate the tank mass. Therefore the by considering the fuel density, the calculation was made by the following formula.

Fuel volume ratio = Fuel Mass Ratio / Fuel Density
Tank mass = Tank pressure * 3.0 / effective tensile * X
Where,
X = Fuel Ratio + Oxidizer Ratio + Propellant Ratio
(Consider all Ratios in Volume)

A. FOR PETROL

$$L = \frac{(W-T)}{0.7372199} \text{ Liters}$$

Where,
W indicates Weight measured by Load Cell,
T indicates Tank Weight,
L indicates Litres which are calculated.
Here Petrol having the density of 737.22 kg/m3.
Hence the proportional values are,
1 Kilogram of vehicle petrol = 1.3564472 Litres
0.7372199 Kilogram = 1 Litre

B. FOR DIESEL

$$L = \frac{(W-T)}{0.885} \text{ Liters}$$

Where,
W indicates Weight measured by Load Cell,
T indicates Tank Weight,
L indicates Litres which are calculated.
Here Diesel having the density of 885.0 kg/m3.
Hence the proportional values are,
1 Kilogram of Diesel = 1.1299435 litres
0.885 Kilogram = 1 Litre

VII. IMPLEMENTATION RESULTS

A. Hardware Initialization

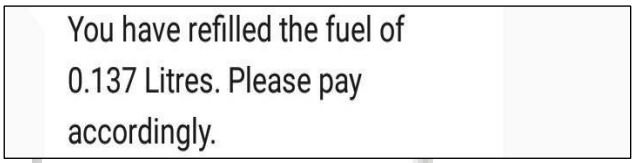
B. Initial Fuel weight

C. Refilling Mode

D. After adding Fuel i.e. Refilled Mode

E. Message Sending Mode by initializing GSM

F. Message to owner



VIII. Analysis

The A/D converter shows the amount of fuel in fuel tank in almost exact litres (Ex: 1.3, 1.4, and 1.5). The accuracy level is upto95 – 98% because the error was around ± 0.2 litres, it displays the almost exact litres on plane roads where we can check the fuel amount.

IX. Conclusion

The Digital fuel indicator likely to be more accurate, more reliable, and cheaper than other analog meters, and will allow for added features that benefit the customer. In the near future, the different vehicle company manufacturers will implement this kind of fuel system which also provides security for the vehicle owners.

X. Limitations

Device requires power supply all the time for successful running. If the power supply fails, it doesn't work.

- It has to wait for power backup.
- It is highly temperature sensitive.

XI. Future scope

- We can provide voice feedback system.
- The use of GPS technology is rapidly increasing. It offers immense benefits in the areas of map guidance to the travellers on roads, surveying areas for printing maps and many other fields. Real time route guiding software's are preferable to the traveller locating hospitals, hotels, petrol pumps was never easy as it is now with the help of GPS.
- The other most important requirement for today's world is security. Automobiles also require security. Numbers of systems are present to deal with security issues. In this system, we have introduced GSM based security system using which a person can check as well as can activate security signals for his vehicle.
- As the fuel monitoring system is applicable for single vehicle, if the owner is having multiple vehicles like travels companies then this can be extended to tracking system where all vehicles' fuel data can be directed to a database and all vehicles can be tracked easily by owner.
- Scope for developing low cost sensors and implementing data acquisition system for storing the data of fuel filings per month or per week if it cannot be monitored continuously.

A. Annexure A: Bibliography

- S.Mohana sundaram, P.Manikandan on Design and Implementation of Load cell based Fuel level Measurement.
- Research Paper "Implementation of Automated Fuel Stock Digital Display for Vehicles" by Prof. Chandrakant Umarani.
- Research Paper "AUTOMATED FUEL MEASUREMENT FOR VEHICLE'S" Vishal H. Gahlot, Abhishek S. Narkar, Dhyan, Asst. Prof. Kavita Joshi.
- https://components101.com/microcontrollers/arduino-uno
- https://www.sunrom.com/p/load-cell-amplifier-for-weighing-scale-serial-output
- https://www.google.co.in/search?q=amplification+circuit+pms63&client=ms-android-xiaomi&prmd=inmv&source=lnms&tbm=isch&sa=X&biw=360&bih=559&sfr=cro&tbs=isz:l&ved=0ahUKEwigl5uSmbPaAhUOTI8KHZu3ANUQlJcCCCEoAg
- https://www.mepits.com/product/185/gsm/gsm-modem-sim-300
- https://circuits.io/pcb
- Nitin Jade, Pranjal Shrimali, Asvin Patel, Sagar Gupta "Modified Type Intelligent Digital Fuel Indicator System" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 20-23 in International Conference on Advances in Engineering & Technology – 2014 (ICAET-2014)
- http://www.speedyjim.net
- http://www.wisegeek.com/what-is-a-fuel-gauge.htm.
- http://www.classictiger.com/mustang/OilPressureGauge.htm
- IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) , "Digital fuel level indicator in two-wheeler along with distance to zero indicator" by A.Avinashkumar, U.Singaravelan, T.V.Premkumar, K.Gnanaprakash
- International Journal and Magzine of Engineering, Technology, Management and Research.
- Daniel R. McGlynn, "Vehicle Usage Monitoring and Recording System", US Patent 4072850, February 1978.

B. Annexure B: Programming

```
#include <LiquidCrystal.h>
```



```
#include <SoftwareSerial.h>
LiquidCrystal LCD(2,3,4,5,6,7);
SoftwareSerial mySerial(10, 9); //(Rx,Tx)
SoftwareSerial mySerial_2 (11, 12); // Rx, Tx
const int buttonPin = 8;
String const number1 = "8983255993";
String const message1 = "You have refilled the fuel of ";
String const message2 = " Litres. Please pay accordingly.";
char weight[10];
unsigned char check = 0;
String weight_str = "";
int weight_int = 0, weight_sub = 0, weight_diff = 0;
float weight_f = 0, weight_sub_f = 0;
int buttonState = 0;
int mode = 0;
void setup()
{
LCD.begin(16,2);
Serial.begin(9600);
while(!Serial)
{
;
}
mySerial.begin(2400);
mySerial_2.begin(9600);
LCD.begin(16, 2);
LCD.setCursor(0, 0);
LCD.print(" Digital Petrol ");
LCD.setCursor(0, 1);
LCD.print(" Indicator ");
delay(2000);
LCD.clear();
Serial.print("Setup-End");
pinMode(buttonPin, INPUT);
mySerial.listen();
}
void loop()
{
Serial.println("In Loop");
getLoadCellData();
if(check >= 7)
{
weight[7] = '\0';
weight_str = weight;
weight_str.replace('[','0');
Serial.print(weight_str);
Serial.print(" --- ");
weight_int = weight_str.toInt();
Serial.println(weight_int);
check = 0;
weight_sub = weight_int - weight_diff;
weight_f = weight_int;
weight_f = weight_f/1000;
weight_f = weight_f/0.7372199;
weight_sub_f = weight_sub;
weight_sub_f = weight_sub_f/1000;
weight_sub_f = weight_sub_f/0.7372199;
if(mode == 0)
{
LCD.setCursor(0, 0);
LCD.print(" Fuel in Litre ");
LCD.setCursor(5, 1);
LCD.print(weight_f, 3);
LCD.print(" ");
}else if(mode == 1)
{
LCD.setCursor(0, 0);
LCD.print("Fuel Refilling..");
LCD.setCursor(0, 1);
LCD.print(weight_f, 3);
LCD.print(" ");
LCD.print(weight_sub_f, 3);
LCD.print(" ");
}
SerialFlush();
}
buttonState = digitalRead(buttonPin);

if (buttonState == HIGH) {
while(buttonState == HIGH)
{
buttonState = digitalRead(buttonPin);
}
if(mode == 0)
{
weight_diff = weight_int;
mode = 1;
}else if(mode == 1)
{
LCD.clear();
LCD.setCursor(0, 0);
LCD.print("Sending Message");
GSM_Init();
delay(1000);
SendSMS();
delay(1000);
LCD.clear();
```

