International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

DESIGN AND FABRICATION OF DIGITAL FUEL MEASURING INDICATOR

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Abstract - *Recently, cases of frauds at the fuel pumps have increased. Most of the fuel stations today have manipulated the pumps such that it displays an amount of fuel as entered but the quantity of fuel filled in the fuel tank is much lesser than the displayed value. The quantity and quality of fuel are tampered for the benefit of the fuel station owners. This results in huge profit for the fuel stations but at the same time the customers are cheated. All the vehicles in India consist of analog meters. Hence it is not possible to precisely know the amount of fuel currently present in the vehicle and also it is not possible to examine the same. Hence, we are trying to develop a "Digital Fuel Meter" which will give the exact amount of fuel poured in the vehicle's fuel tank. The device circuit will be fitted in a small compartment inside the fuel tank and the meter reading will be shown on the LCD display outside the fuel tank.*

Key Words: **Arduino Board, Hall effect sensor, LCD**

1. INTRODUCTION

Nowadays, vehicles use analog or digital fuel indicators. These fuel level indicators show the amount of fuel present in the fuel tank in bar form, as shown in figure 1 and figure 2. The main disadvantage of this system is that it does not show the amount of fuel poured or present in the tank in numerical values. Hence, this problem is taken into consideration for this project which shows the exact amount of fuel poured in the fuel tank in numerical values. The conventional types of fuel indicators consist of two parts:

1. The sensing unit - in the tank

2. The indicator - on the dashboard

Fig 1: Analog fuel meter

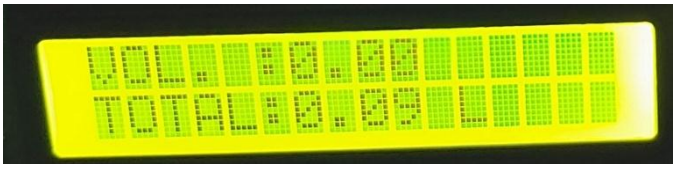

Fig 2: Digital fuel meter

2. LITERATURE REVIEW

The following chapter discusses the literature survey done in fuel meter. The chapter further describes history, background and different types of flow meter.

Author Siddique Reza Khan in Oct 2013 developed a Real Time Generator Fuel level Meter Embedded with Ultrasound Sensor and Data Acquisition System. This project has an Ultrasound Sensor module, Liquid Crystal Display to show the updates, a micro SD card for data acquisition and Real Time Clock to give accurate time and date. The whole system is controlled by two PIC microcontrollers 18F4520. [1]

On October 2016, a journal was published by Rahul S. Vaidya on digital fuel indicator system. The author specifies the use of liquid pressure sensor which works on the principle of piezoelectric effect which is then calibrated to the fuel tank. Calibration result of the liquid pressure sensor is linear than the Float level sensor and hence it can be used to measure level of the tanks. [2]

In the year 2017, Mrs. P. Geetha Bai published a paper on Design and Implementation of GSM Based Digital Fuel Meter and Fuel Theft Detection Using PIC Microcontroller PIC16F877A Microcontroller. LCD (16x2) is connected to Microcontroller to display the level of fuel. After ignition LCD will display current value of fuel level. [3]

In the year 2017, Dr. G. Prathyusha published a paper on Embedded Based Flow Control Using Fuzzy YF-S201 Hall Effect Water Flow Meter / Sensor. This

sensor placed in line with the water line and contains any simple level sensor to measure how much liquid has pumped through it. There is an integrated magnetic Hall Effect sensor that outputs an electrical pulse. The Hall Effect sensor is sealed that allows the sensor to stay safe and dry. The sensor comes with three wires: red (5-24VDC power), black (ground) and yellow (Hall Effect pulse output). By counting the pulse from the output of the sensor, user can easily calculate water flow. [4]

3. RELATED WORK

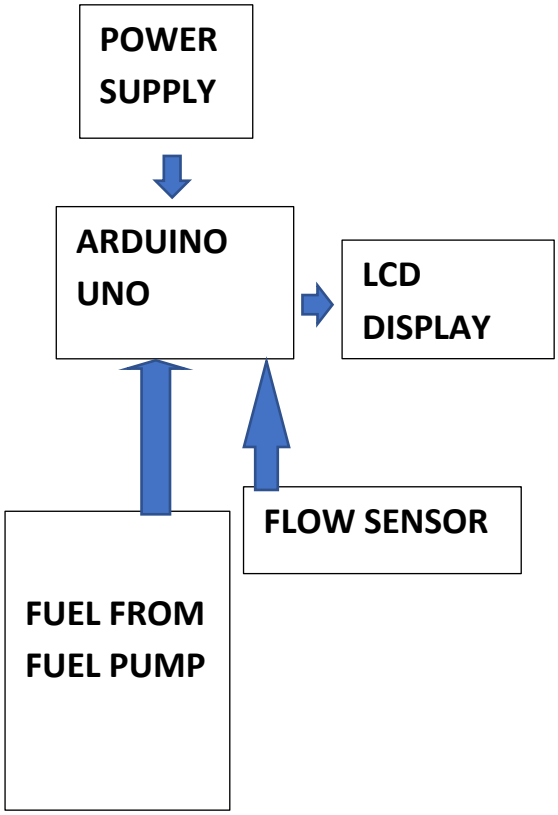

Fig 3: Layout of flow meter circuit

In the system, the microcontroller ATmega328 is used. This controller is extremely easy to operate. The coding or programming of this controller is additionally simpler. ATmega328 finds its application in a huge number of devices like remote sensors, security and safety devices, home automation, etc. It is very easy to use for beginners whereas flexible enough for intermediate and advanced users. It can easily work on windows, Mac, and Linux. All over the world many Teachers and students use it to build economical scientific instruments, to prove physics and chemistry principles, or to get started with programming and robotics. It has the Harvard architecture where the program data and program code have separate memory. It consists of two types of memories which are Data memory and the Program memory. The data is stored in the data memory and the code is stored in flash program memory. 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz. The ATmega328 has 32 KB of flash memory for storing code including 0.5 KB for the boot.

The basic block diagram of the digital flow meter is given in the fig 3. It consists of the following components: Arduino UNO Board, LCD display, IOT module and Flow Sensor. The Arduino Flow Meter works on the principle of hall effect. Hall effect is applied in the flow meter using a small fan which is placed in the path of the liquid. The liquid pushes against the fins of the rotor causing it to rotate. A pulse is induced as this rotor rotates. We measure the number of pulses using an Arduino and then calculate the flow rate in litres per minute (L/m) (or in ml/m) using a simple conversion formula which will be displayed on the LCD screen. [5]

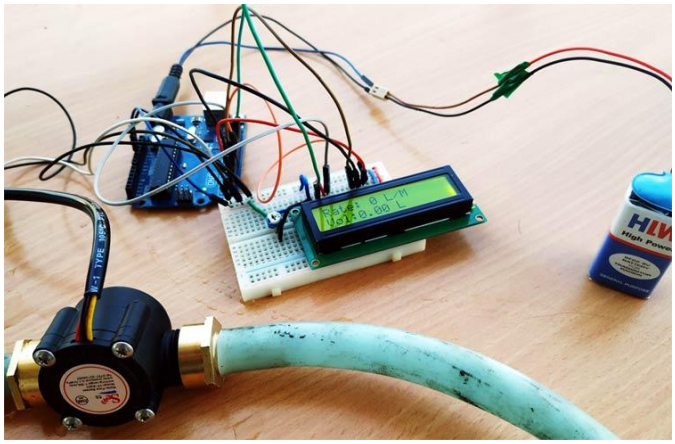

Fig 4: Circuit of digital fuel indicator

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

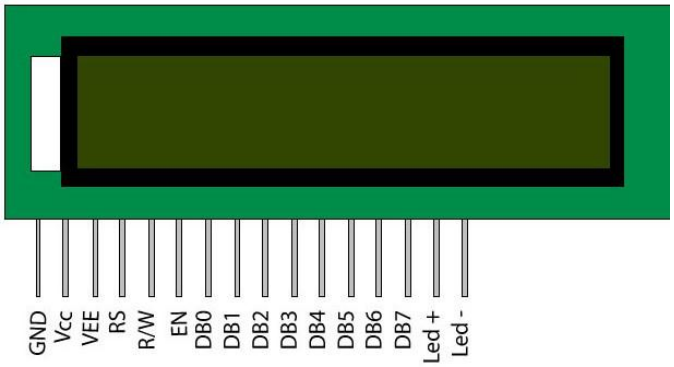

Fig 5: Liquid crystal display

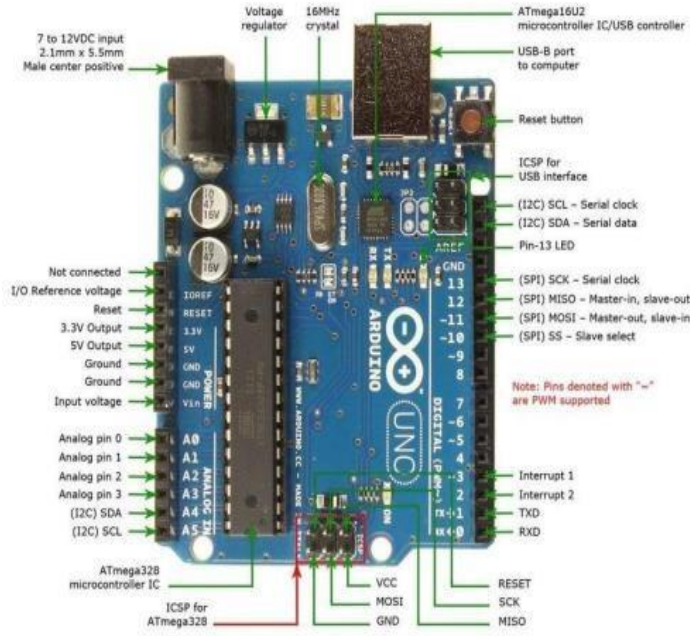

Fig 6: Arduino board

We will be using a 16x2 LCD for display. When an electrical current is applied the liquid crystal, molecules tends to untwist. Due to this, there is an angle of light which passes through molecule of polarized glass and also changes the angle of filter. Thus, some area of LCD will become darker than other. While making LCDs, an electrode of indium-tin oxide is kept on top and a polarized glass with polarized film is kept below of the device. A reflector mirror is placed at the back. The whole region of LCD has to be enclosed by a common electrode and there should be a liquid crystal matter above it. There is another glass with an electrode in the form of rectangle at top and bottom of other polarizing film. Both the glasses should be kept at right angle. When current is not supplied, light passes through the front of LCD. It'll be reflected by the mirror and bounced back. When current is supplied, liquid crystals between common plane electrode and rectangular electrode untwist. Thus the light is blocked from passing through. That particular rectangular area appears blank. [6]

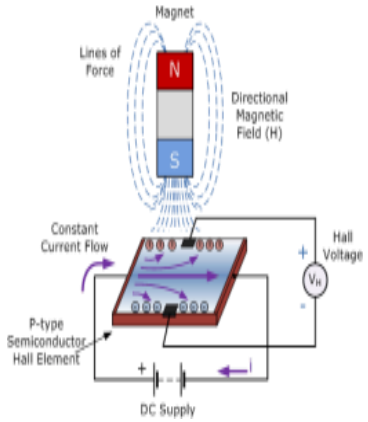

Fig 7: Hall effect

Hall Effect Sensor is a device in which external magnetic field is used to activate the system. As we know magnetic field has two main terms, which are flux density (B) and polarity (N and S Poles). The output signal of sensor is the function of magnetic field density around the device. An output voltage is generated as soon as the magnetic flux density around the sensor exceeds a certain pre-set threshold, and this voltage is called the Hall Voltage (VH). [7]

4. CODE

```
#include <LiquidCrystal.h>

LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

int X; int Y; float TIME = 0; float
FREQUENCY = 0; float WATER =
0; float TOTAL = 0; float LS = 0;
const int input = A0; void setup() {
Serial.begin(9600); lcd.begin(16,
2); lcd.clear(); lcd.setCursor(0,0);
lcd.print("Water Flow Meter");
lcd.setCursor(0,1);
lcd.print("****************");
delay(2000);
pinMode(input,INPUT);
```

```
}

 void loop()

{

X = pulseIn(input, HIGH);

Y = pulseIn(input, LOW);

TIME = X + Y;

FREQUENCY = 1000000/TIME;

WATER = FREQUENCY/7.5;

LS = WATER/60;

if(FREQUENCY >= 0)

{ if(isinf(FREQUENCY))

{ lcd.clear();

lcd.setCursor(0,0);

lcd.print("VOL. :0.00");

lcd.setCursor(0,1);

lcd.print("TOTAL:");

lcd.print( TOTAL);

lcd.print(" L"); } else

{

TOTAL = TOTAL + LS; Serial.println(FREQUENCY);

lcd.clear();

lcd.setCursor(0,0);

lcd.print("VOL.: ");

lcd.print(WATER);

lcd.print(" L/M");

lcd.setCursor(0,1);

lcd.print("TOTAL:");

lcd.print( TOTAL);

lcd.print(" L"); } }

delay(1000);

}
```

5. RESULT

We conducted a test for testing the accuracy of the fuel meter and as shown in figure 8, we can see that on pouring 0.10 L of Fuel through the sensor the digital fuel indication is giving an output of 0.09 L. In this way, we get the fuel level in the digital format. Thus, also we get a result with an accuracy of 90%.

Fig 8. Digital Fuel Meter

6. CONCLUSION

Digital Fuel Meter can be used for prevention from the frauds taking place at petrol pumps. This meter has an advantage over the analog meter. By using the Arduino Uno and GSM, the owner of the bike is always aware of the fuel input into the tank through the SMS sent to his/her mobile or the data will be saved on the IOT. We can increase the standard of measurement using Digital Fuel Meter and the performance of the automobile can also be improved.

7. FUTURE SCOPE

- Day by day we see a news of impure fuel being given by petrol pump which reduces the engine life and this is also a kind of fraud with customer. As our device gives exact amount of fuel poured in fuel tank in addition to that we can use density sensor with it which will help in detection of impurity of fuel

- In addition to above feature with the help of Density sensor we can detect whether fuel being

poured is petrol or diesel, this feature will avoid the problem of wrong fuel poured in fuel tank by mistake.

- Device can also predict the exact amount of fuel present in fuel tank, with the help of this feature, device can also predict that how much distance that particular vehicle can travel with current amount of fuel.

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