International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 06 | June 2018 www.irjet.net p-ISSN: 2395-0072

Digital Fuel Metering Device.

Mr. Umesh .A. Shatter[1], Ziya .H. Shaikh[2], Jonah .J. David[3]

[1,2] B.Tech. students, Department of Mechanical Engineering, MITAOE, Pune, Maharashtra, India.
[3]Student, Diploma in Automobile Engineering, M.M. Polytechnique, Thergaon, ,Pune, Maharashtra, India

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Abstract - *Now-a-days, we know that the fuel is being thieved at petrol stations. Various tricks are used to steal the fuel like a faulty meter, hose pipe longer than required, distracting the customers, etc. Due to this, a lot of economy of the customers is being wasted at fuel stations. The "Digital fuel metering device" is a fuel flow measuring meter which is compact, light weight and very cost-effective solution for measuring fuel for two wheelers. Its unique features for protecting and preventing theft of fuel and the protection against overstatement of readings. For this device we used a turbine flow sensor and microcontroller "AT89C51" and this device is fabricated on the fuel tank of two wheeler.*

Key Words: **Flow sensor, Digital fuel metering device, Fuel tank, Faulty meter, Fabrication.**

1.INTRODUCTION

Over the years at fuel stations we are getting cheated and thieved by not getting the accurate amount of fuel. Due to the software changes done in the fuel dispenser, the meter is running but the proper amount of fuel is not discharged in our vehicles fuel tank. So the digital fuel metering device is the solution for all these problems which saves the common persons economy.

This project uses the flow meter for measuring the amount of fuel being discharged in the fuel tank. It consists of turbine flow sensor with the range from 1 litre per minute to 30 litre per minute as the flow of fuel for small vehicles is up to 30 litre per minute so this sensor is best suited for the operation. Also consists of AT89C51 8 bit microcontroller, 16x2 LCD display, power supply with LM 7805 voltage regulator and bridge type full wave rectifier. For the power supply two wheelers battery (Lid acid battery) is used having 12.5 volt & 2.5 Ah.

Digital fuel metering device with microcontroller mounted on the vehicles fuel tank and the turbine flow sensor at the fuel tanks inlet measures the proper amount of fuel entering in the fuel tank.

2. NECESSITY OF DIGITAL FUEL METERING DEVICE

Now a days at almost at every fuel stations we get cheated by getting incorrect amount of fuel in the fuel tank.. Due to the software changes done in the fuel dispenser, the meter is running but the proper amount of fuel is not discharged in our vehicles fuel tank. So the digital fuel metering device is the solution for all these problems which saves the common persons economy.

Following are some tricks by which they fraud us:

1) **A faulty meter**
Some petrol pumps have rigged meters that start ticking even before petrol starts to flow from the hose. A motorist encountered such a meter at a station near Hosur in Tamil Nadu and created a scene at the pump. The manager gave him Rs 500 off.

2) **A fuel hose longer than is required**
Pumps save on a lot of petrol when they use long pipes. A perfectly good meter will show that a certain amount of petrol has been pumped out, but that amount hasn't reached your tank - some of it is still in the pipe, and it goes back into the pump. Through the day, the number of litres that stations save can be enormous.

3) **Sticking fingers firmly in the nozzle of the hose**
This reduces the flow speed of the fuel and can save up to a litre at a time for the station.

4) **'Double-checking' the required amount**
The attendant asks you how much petrol you want. You say you want petrol worth Rs 1,000. He stops at Rs 200 while configuring the meter, and reconfirms, and 'updates' the value by Rs 800. You might think that you are receiving petrol for Rs 1,000 - but you are only getting petrol for Rs 800, as he has not actually reset the meter. [1]

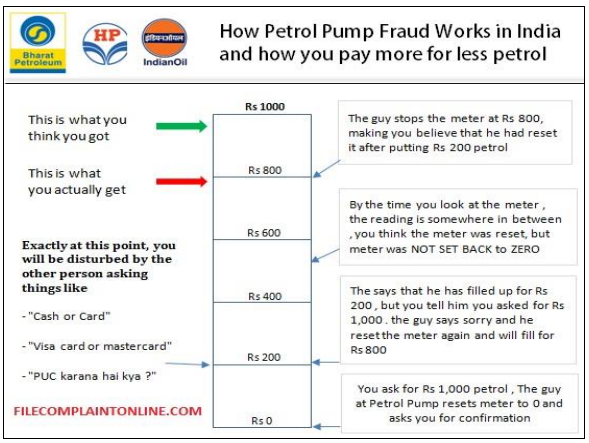

Fig -1. Fraud tactic used at Petrol Pump [2]

3. BLOCK DIAGRAM

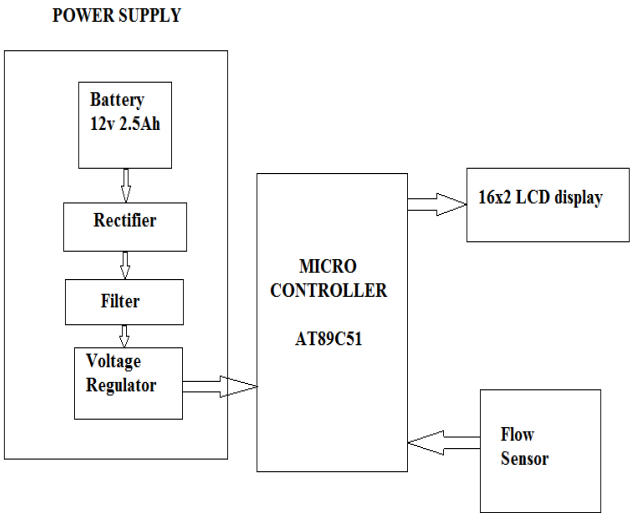

Fig -2. Block Diagram

- **Microcontroller**: The signals from the sensor are given to the Microcontroller. Microcontroller processes all these signals and gives data to LCD display.
- **LCD display**: It is used to display the information to the user.
- **Flow sensor**: It senses the flow of petrol and sends the signal to the microcontroller.
- **Battery**: It supplies 12v DC supply to the microcontroller, flow sensor, LCD display and throughout the circuit.
- **Rectifier**: It converts AC into pulsating DC by using diodes, this process is called as rectification.
- **Filter**: It is used to remove the AC signal from the output of the rectifier. It is used in order to remove ripples from the pulsating DC and convert it to unregulated DC.
- **Voltage regulator**: It is an electrical regulator designed to automatically maintain a constant voltage level.

4. COMPONENTS

The functioning of entire device depends upon the four important parts. They are:

1) Turbine flow sensor

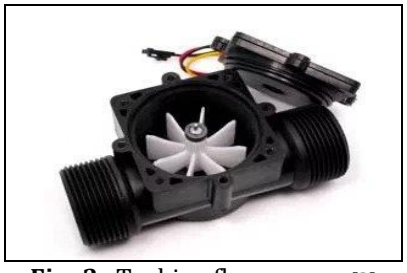

Fig -3. Turbine flow sensor [3]

The sensor is fitted on the fuel tank and comes with three wires: red (5-24VDC power), black (ground) and yellow (Hall effect pulse output). By counting the pulses from the output of the sensor, the flow can be easily calculated. And the output wire of the sensor is connected to the microcontroller. Each output pulse is approximately 2.25 milliliters. This sensor contains a pinwheel sensor to measure how much liquid has moved through it. There's an integrated magnetic hall effect sensor that outputs an electrical pulse with every revolution.

The pulse signal is a simple square wave so it's quite easy to log and convert into liters per minute using the following formula.

Pulse frequency (Hz) / 7.5 = flow rate in L/min [4]

2) Microcontroller AT89C51

In our device the microcontroller used was AT89C51.The AT89C51 is a low-power, high-performance 8-bit microcomputer with 32 I/O lines. For operating of microcontroller, 5V power is given to it through our power supply. The flow sensor's input red wire is connected to the microcontroller for working of flow sensor and output yellow wire of sensor is also connected to the microcontroller for calculating the output pulse and thus flow of fuel in terms of liter. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to our device.

3) Power supply

Our power supply consist of an automotive battery, full wave bridge rectifier, capacitor filter, voltage regulator. The battery used in our project is having 12V and 2.5Ah. Rectifier is used in the circuit to convert AC current into a DC current There is no need of rectifier in our device as automotive battery supplies DC current, in spite we used rectifier for the safety purpose. In full wave rectifier there are four diodes and the diodes in our circuit is 1N4007. We have used filter capacitor to remove the AC signal from the output of rectifier. Filter capacitor is used to remove ripples from the pulsating DC and convert it into unregulated DC and it is also used as energy storage devices in the electrical circuits, Voltage regulator is used in our device to maintain and regulate constant voltage level. We have used LM7805 regulator because our microcontroller operates under positive series. '78' indicates positive series and '05' indicates voltage rating.

5. WORKING

The Digital fuel metering device works on 12 volts supply from the two wheelers battery. The device uses turbine flow sensor for measuring the amount of fuel passing in the fuel tank. When the fuel flows through the sensor, the rotor starts to rotate along with the pinwheel attached to the rotor. The speed of the rotor is directly proportional to the rate of flow. Due to the hall effect within the sensor the rotation of the pinwheel gives output as PMW signal (Pulse Modulator Width) for every rotation. This PMW signal is send to the interrupted pin of the microcontroller AT89C51, then microcontroller counts the number of pulses and the rate of flow will be directly proportional to the number of pulses counted.

The sensor have three pins i.e red, black and yellow. Red (5V-24V), black (ground) and yellow (output pulse). The microcontroller runs on the 5V DC and 1 ampere current. After calculating the pulses from the sensors output, the 2x16 LCD display shows the reading in terms of litres.

After the reading is displayed on the LCD display the reset button is pressed. The reset circuit gives the required starting pulse to the microcontroller to start the operation from the very beginning

6. ADVANTAGES

- Saves common person's economy which is fraud or thieved at the fuel stations.
- Easy to install.
- Low maintenance.
- Can be fitted in any two wheeler and also four wheeler.
- It is reliable.
- Simple in operation.

7. DISADVANTAGES

- Bulky design of unit, can be overcome by modifications.

8. FUTURE SCOPE

- By using advanced technology in electronics like SMD components the microcontroller could be made more compact and light weight.
- By advanced fabrication techniques on the digital fuel metering device, the bulkiness and non-aerodynamic effects could be eliminated.
- In future we can use it in all types of vehicle.
- In future we can use an alarm/buzzer to indicate the theft of fuel

9. ACTUAL DEVICE FITTED ON THE FUEL TANK

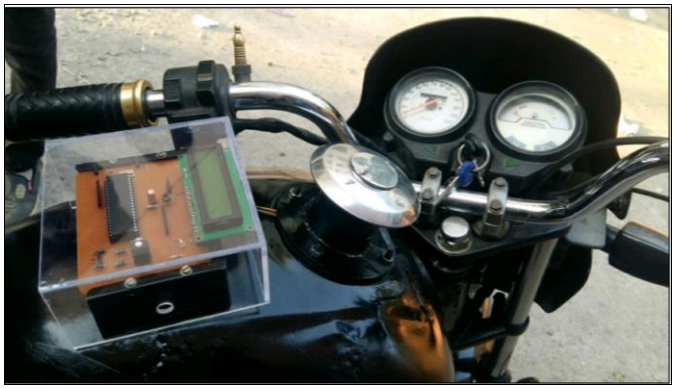

Fig -4. Digital Fuel Metering Device

10. CONCLUSION

The Digital Fuel Metering Device which uses turbine flow sensor effectively calculate the amount of fuel entering the fuel tank. This device will save common peoples economy which is been thieved or fraud at the fuel stations.

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