SMART FUEL METERING SYSTEM

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Abstract - *Petrol pump frauds were very common in 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 exact, so it is not possible to measure exact amount of fuel inlet. In this modern and progressive world, products are being digitized owing to its benefits, user friendliness. So we are developing a project named "Automated Fuel Measurement for Vehicle". It consists of creating a digital display for the exact volume of fuel contained in the fuel tank. The above developed fact is considered in the project and it's found out that an effective solution for indicating the exact inlet of fuel in the tank digitally. A sensor and a microcontroller are used to find out the fuel inlet which is less costly and also exact. This paper is concentrating on the study of various fuel measuring sensors suitable for our developed project. Some problems with respect to the existing fuel measurement techniques are recognized and hence a better digital sensing technology has been developed, described and justified.*

***Key Words*: Fuel metering, microcontroller, Arduino**

1. INTRODUCTION

Accurate flow measurement is an essential step both in the terms of qualitative and economic points of view. Some of the meters like velocity meters use a sensor which calculates the flow rate based on the speed of water, ultrasonic sensors which works on two different principles that is transit time measurement principle and other is based on Doppler Effect but these are having high cost of maintenance. Now a days everything is digital in all over field. Digital fuel meter is also implemented in two wheeler, but they do not shows the exact fuel level which is present in the tank i.e. they shows the amount of fuel in terms of bars and not in numbers or digits like liter or milliliter. That's why we do not get proper idea about fuel present in our tank. We get only approximate level of fuel. So this problem is taken into consideration for our project work of developing the Digital (numeric) fuel indicator system for two wheelers which shows exact amount of fuel in terms of liter or milliliter. This project mainly concentrates about the indication of fuel level in vehicles. Various other features like the distance can be travelled to the corresponding fuel, is added with this arrangement which will explain the clear performance of the vehicle to the corresponding fuel. In the recent times we are constantly hearing about petrol stealing. Most of the petrol bunks today have fraud the pumps such that it displays the amount as entered but the quantity of fuel filled in the customer's tank is much lesser than the displayed value. Yet the pumps are tampered for the benefit of the petrol bunks owner. This results in huge profits for the petrol bunks 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 in the vehicle and also it is not possible to cross check the quantity of fuel filled in the petrol bunk. In this project we focuses on creating a digital display of the exact amount of fuel contained in the vehicles tank and also help in cross checking the quantity of fuel filled at the petrol theft. There are many sensor is based on the market available techniques for measurement of level and there is a narrow idea of the quantity of fluid, but it can be an accurate approximation of the quantity as in cars by fuel m where an idea of whether the tank is full, half full or empty, etc. can be determined. The fill level of the detector and the Optimizer play an important role in tanks for the specification of the liquid of a specific density. This device Digital displays the level of the liquid in the tank, fuel composition & current function of the vehicle using the load sensors. A fuel level detector (tank display) is a device in a car or another vehicle, measures the amount of fuel remaining in the vehicle. This type of system can be used to measure the amount of gasoline or any other type of liquid. There is usually or sensor measures the amount of fuel actually and leaves a dial indicator or indicator, passes this information outside of the container. A tank display can be designed in a number of different ways and many measuring devices are several deficiencies, the measured values can be less accurate. The two parts of the fuel gauge are the remote sensing or sensor and the display or display. A sensor unit is the part of a tank display within or to the actual storage containers on a single vehicle.

2. SYSTEM OVERVIEW

As we know that the particular project is a real time project which is highly concerned about the petrol stealing by petrol frauds. This project has several components like:

1. Fuel Flow Meter

2. Pipes

3. Fuel Tank

4. Magnetic Pic-off

5. Signal Conditioning Unit

6. Digital Display

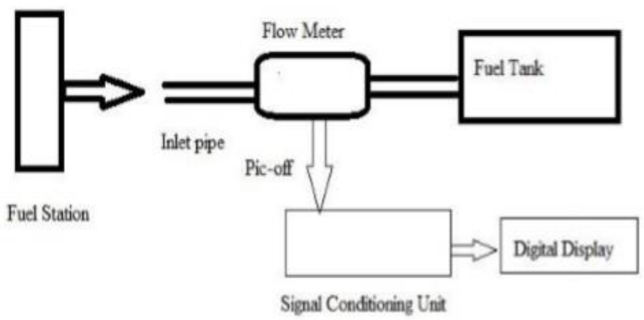

Fig-1: System Schematic

The basic theory behind liquid turbine meters is relatively simple. Fluid flow through the meter impinges upon the turbine blades which are free to rotate about an axis along the center line of the turbine housing. The angular (rotational) velocity of the turbine rotor is directly proportional to the fluid velocity through the turbine. These features make the turbine meter an ideal device for measuring flow rate. The output of the meter is taken by an electrical pickoff(s) mounted on the meter body. The pickoff's output frequency is proportional to the flow rate. In addition to its excellent range ability, a major advantage of the turbine meter is that each electrical pulse is also proportional to a small incremental volume of flow. This incremental output is digital in form, and as such, can be totalized with a maximum error of one pulse regardless of the volume measured. The turbine meter and associated digital electronics form the basis of any liquid metering system. An expanding blade hanger assembly holds the turbine rotor in alignment with the fluid flow. The angle of the turbine blades to the stream governs the angular velocity and the output frequency of the meter. A sharper blade angle provides a higher frequency output. In general, the blade angle is held between 20° and 40° to the flow. Lower angles cause too low of an angular velocity and loss of repeatability, while larger angle causes excessive end thrust.

2.1 Flow Rate Is Proportional to Angular Velocity

Figure below is a cross section of the internals of turbine flow meter. Flow through the turbine meter is from left to right. The forward and rear suspension act as flow guides, ensuring fluid motion through the meter is parallel to the meter's centerline. Flow impinging upon the angular blade causes the rotor to spin at an angular velocity proportional to flow rate.

Fig-2: Flow Meter

2.2 Rotor Design

Flowing fluid enters the turbine through the forward suspension. When it encounters the sharp angle of the upstream cone, the stream is deflected outward, increasing in velocity and causing a slight static pressure drop. As the fluid leaves the blade area, flow has redistributed. Velocity is reduced slightly and static pressure has increased proportionally. The difference between the two velocity pressures causes the rotor to move upstream into the fluid flow. A slight offset ensures this upstream force will not cause the rotor to strike the forward thrust bearing. The cross sectional area of the cone is slightly smaller than that of the rotor hub with some flow impinging directly upon the rotor hub, generating a downstream thrust.

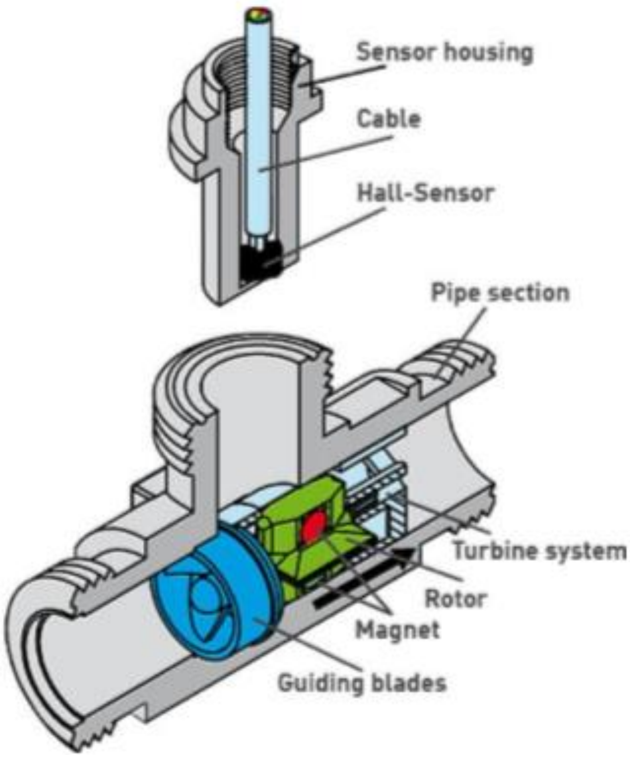

Fig-3: Assembly Cross Section

As a result, the rotor floats in balance between upstream and downstream cones, pushed forward by the pressure difference across the blades and pushed backward by the flow impingement. The only bearing surface other than the measured fluid is the cemented carbide sleeve bearing inserting bi-directional meters, a second upstream cone replaces the downstream cone and range ability is reduced in reverse flow.

2.3 Design Considerations:

1. Maximum Flow rate of fuel entering in pipe from fuel station is 37 LPM.

2. Flow enters in tangential direction into Turbine flow meter.

3. Head imparted on fuel.

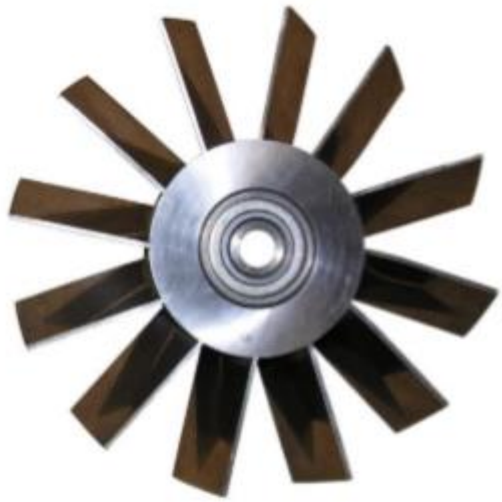

Fig-4: Rotor Blade

Rotor Blade Diameter of outlet of petrol pump, d= 25.4 mm (1 inch)

Discharge from petrol pump= 10 LPM=1.667*10-4 m3/s

Cross sectional area of nozzle= (pi*d2)/4=pi*0.02442/4=0.000506 m2

Discharge =Area*velocity Velocity=0.329m/s

When fuel enters in turbine,

Hub Diameter =0.35*outer diameter

Area in turbine= (pi/4)*(outer dia.2 – hub dia.2)

We get outer diameter= 28.5 mm= 1.122 inch

But standard available rotor size is 1.5 inch (38 mm)

Therefore, Rotor Diameter= 1.5 inch i.e. 38 mm.

2.4 Hall Effect Sensor

A Hall Effect sensor is a transducer that varies its output voltage in response to a magnetic field. Hall Effect sensors are used for proximity switching, positioning, speed detection, and current sensing applications. In its simplest form, the sensor operates as an analog transducer, directly returning a voltage. With a known magnetic field, its distance from the Hall plate can be determined. Using groups of sensors, the relative position of the magnet can be deduced.

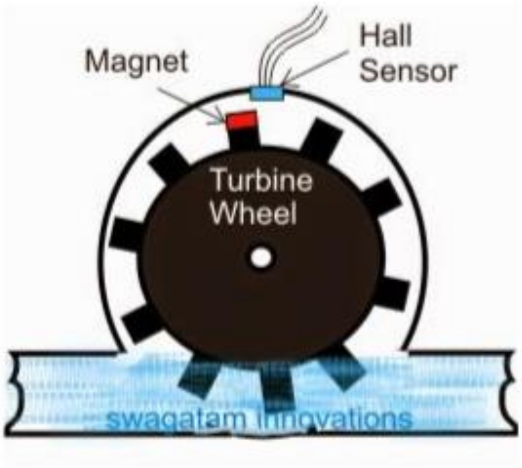

Fig-5: Hall Effect Sensor

Frequently, a Hall sensor is combined with threshold detection so that it acts as and is called a switch. Commonly seen in industrial applications such as the pictured pneumatic cylinder, they are also used in consumer equipment; for example some computer printers use them to detect missing paper and open covers. They can also be used in computer keyboards applications that require ultra-high reliability. Hall sensors are commonly used to time the speed of wheels and shafts, such as for internal combustion engine ignition timing, tachometers and anti-lock braking systems. They are used in brushless DC electric motors to detect the position of the permanent magnet. In the pictured wheel with two equally spaced magnets, the voltage from the sensor will peak twice for each revolution. This arrangement is commonly used to regulate the speed of disk drives.

2.5 Final System

Electronic system consists following:

1. Arduino

2. LCD Display

Here in this system arduino is programmed, such that it calculates the count of rotation by hall effect sensor and then displays it on LCD display.

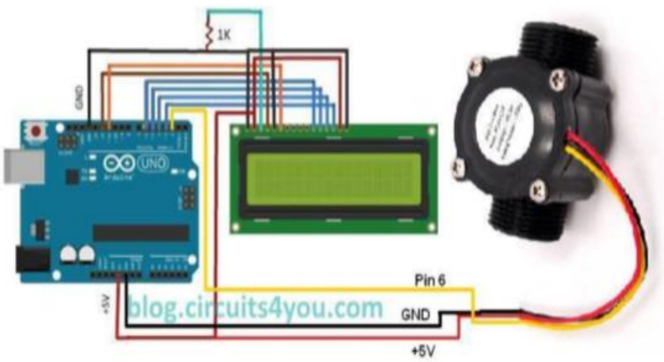

Fig-6: Final Virtual Electronic System

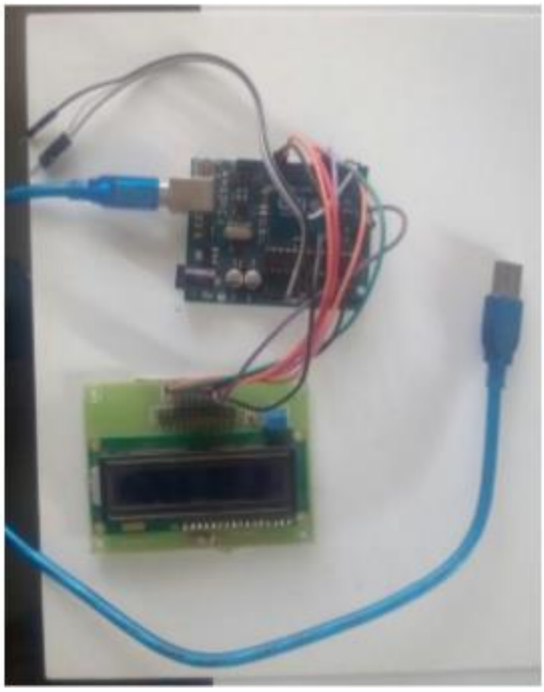

Fig-7: Final Electronic System

Fig-8: Fuel Tank with Flow Meter

Here flow meter will be part of fuel tank and when rotor will start rotating sensor will count the rotations. Accordingly it will show the fuel filled in tank.

3. CONCLUSION

The existing float based measurement techniques are far from exact measurement, but the microcontroller based technique is more exact compared to the existing technique but still that is not more exact due to fuel floundering in the tank. Sensor is graded with respect to the inlet of fuel to the tank. So by using any one of the level measuring sensor mentioned above will be more exact, more reliable, and cheaper than other analog meters, and will allow for added features that benefit both the consumer. In the future, the different vehicle company manufacturers will implement this kind of fuel system which also provides security for the vehicle. Not that only the measurement be more exact, and the consumers also will not be cheated for their hard earned money.

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