International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 5.22 (SJIF-2017), e-ISSN: 2455-2585
Volume 4, Issue 6, June-2018

FUEL QUANTITY MEASUREMENT USING MECHANICAL FLOWMETER IN AN AUTOMOBILE FUEL TANK

Sunil Prashanth Kumar[1]

[1]*Department of Automobile Engineering, New Horizon College of Engineering,*
sunilbeck@gmail.com

Abstract—***People generally have doubt about the amount of fuel pumped into the fuel tank while filling fuel from a fuel station, the fuel coming from the petrol pump through the petrol gun is calibrated by the flow meter which is fitted onto the petrol gun. These readings are displayed on the pump display. In this paper a mechanical turbine flow meter is fitted in a housing which is mounted on the neck of the fuel tank, when the fuel from the fuel gun flows this flow meter, amount of fuel flowing into the fuel tank is calibrated and fuel quantity value in litres is displayed on the digital display provided. This system ensures the quantity of fuel and avoids the ambiguity of the people who doubt the fuel station fuel pump calibration system.***

Keywords— Fuel, petrol pump, flow meter, calibration, digital.

I. INTRODUCTION

The main idea of this project is to develop a product in an automobile fuel system. This product helps in calibration of fuel i.e. petrol or diesel. The fuel coming from the petrol pump through the petrol gun is calibrated by the flow meter which is fit onto the petrol gun. These readings are displayed on the pump display. There is a myth/doubt usually about the quantity of fuel that reaches the fuel tank. In order to clear such doubts, a prototype/model with a flow measurement device that is fitted into an automotive fuel tank inlet such that it allows the passage of fuel into the flow meter which can calibrate the amount of fuel flow into the fuel tank, which is then connected to a measurement device either digital or analogy display for the convenience of the consumer.

Flow measurement is the quantification of bulk fluid movement. Flow can be measured in a variety of ways. A flow meter is an instrument used to measure linear, nonlinear, mass or volumetric flow rate of a liquid or a gas.

Positive-displacement flow meters accumulate a fixed volume of fluid and then count the number of times the volume is filled to measure flow. Other flow measurement methods rely on forces produced by the flowing stream as it overcomes a known constriction, to indirectly calculate flow. Flow may be measured by measuring the velocity of fluid over a known area.

Both gas and liquid flow can be measured in volumetric or mass flow rates, such as litres per second or kilograms per second, respectively. These measurements are related by the material's density. The density of a liquid is almost independent of conditions. This is not the case for gasses, the densities of which depend greatly upon pressure, temperature and to a lesser extent, composition.

Different types of flow meters are available such as, piston meter/ rotary meter, oval gear meter, heligal gear meter, nutating disk meter, variable area meter, woltmann meter, single jet meter, multijet meter, pelton wheel meter and turbine flow meter.

II. METHODOLOGY

- Select the suitable flow meter
- Design the structure of the fuel passage inlet towards the flow meter
- Reduce inaccurate readings in calibration of measurement of fuel flow, by reducing vortex or swirl actions.
- Estimate the upper limit of pressure the structure and the flow meter can withstand
- Design a universal/standard prototype for convenience in using the system on different automotive fuel tanks

III. Work done

A. *Selection of the flow meter:*

When the volumetric flow of incompressible liquids is measured, the presence of suspended bubbles will cause error; therefore, air and gas must be removed before the fluid reaches the meter. In some flow meters, pipe lines can cause problems, or the meter may stop functioning if the Reynolds number is too low. In view of these considerations, flow meters, which are insensitive pressure and viscosity variations and are not affected by changes in the Reynolds number, should be kept in mind. Keeping in mind the above conditions, cost and availability, turbine flow sensor has been selected.

Turbine flow meter: The turbine flow meter (better described as an axial turbine) translates the mechanical action of the turbine rotating in the liquid flow around an axis into a user-readable rate of flow (gpm, lpm, etc.). The turbine tends to have all the flow traveling around it.The turbine wheel is set in the path of a fluid stream. The flowing fluid impinges on the turbine blades, imparting a force to the blade surface and setting the rotor in motion. When a steady rotation speed has been reached, the speed is proportional to fluid velocity.The flow direction is generally straight through the meter, allowing for higher flow rates and less pressure loss than displacement-type meters.

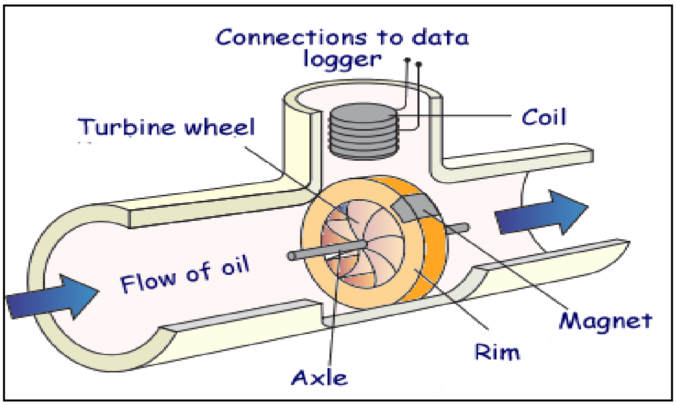

Fig. 1: Schematic of a turbine flow meter

Micontroller:PIC18F4550 Interrupt microcontroller was used with digital display unit

B. *Design of flow line.*

Various flow line designs were fabricated and realtime testing was done (explained in the fabrication and testing section). Care should be taken to make sure the fuel pumped into the fuel tank mouth should move on the turbine blades on the flow meter. Due to high pump pressure, there is a possibility that considerable amount of fuel may move along inner walls of the flow meter casing without touching the turbine blades, this amount of fuel will not be calibrated.

Fuel flow line should be designed such that all the fuel will move over the blades for accurate calibration. To ensure this a small storage unit is made, where the fuel pumped into the fuel tank mouth will settle and then move though a hollow tube and then through a converging nozzle. The converging end of the nozzle is positioned just over the turbine blades such that all the fuel will move over the blades. Thus accurate calibration is achieved.

C. *Fabrication and Testing*

Different design of Flow pipe before the turbine flow meter were fabricated and tested, depending on the calibration results, minor modifications to the flow pipe (entry end of the flow meter) were made and a best design was finalized. The different design and testing trials for different designs of the flow pipe (entry end of the flow meter) is as follows.

1) **Trial 1:**

Design: Direct flow of fuel on to the flow meter through a pipe.

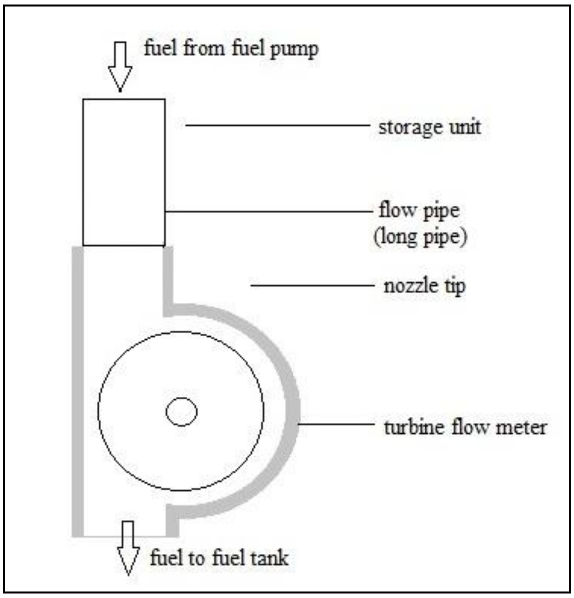

Fig 2: long flow pipe attached to flow meter

Calibration results:

Measured quantity (ml)	Calibrated quantity(ml)	Error (ml)
400	230	170
500	345	155

Using the above design resulted in high error value due to varying pressure, flow rate and overflow of fuel (moving along the inner wall of the flow meter casing without touching the blades). Also use of long pipe gave room for mixing of fuel with air (air was also calibrated)

2) **Trial 2:**

Design: Direct flow of fuel on to the flow meter through a short pipe

(The length of the pipe was shortened)

Calibration results:

Measured quantity (ml)	Calibrated quantity (ml)	Error (ml)
400	280	120
500	375	125

To avoid air gap the length of the pipe was shortened. This resulted in reducing the error factor. Since there was no constant uniform flow, the calibration had errors. Also some amount of fuel was not touching the blades similar to the previous case.

3) **Trial 3:**

Design: Flow of fuel on to the flow meter through short pipe with nozzle

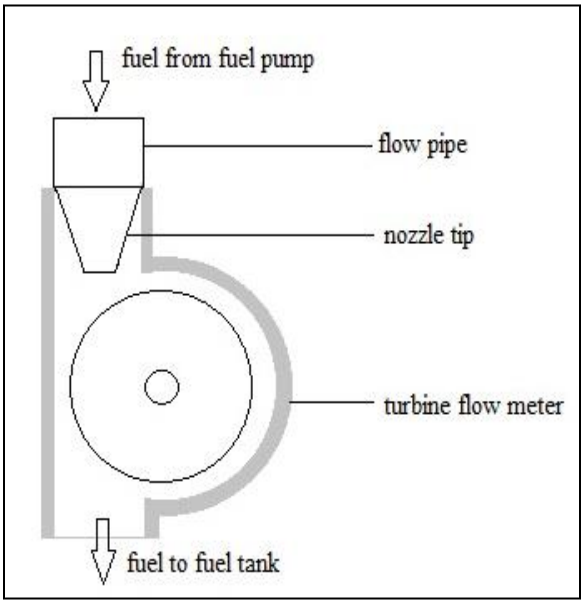

Fig 3: Flow pipe (short pipe with nozzle) attached to turbine flow meter

Calibration results:

Measured quantity (ml)	Calibrated quantity (ml)	Error (ml)
400	360	40
500	450	50

Use of nozzle tip enabled fuel move over the blades. Since there was no constant uniform flow, the calibration had errors.

4) **Trial 4:**

Design: flow of fuel on to the flow meter through storage unit, short pipe and nozzle

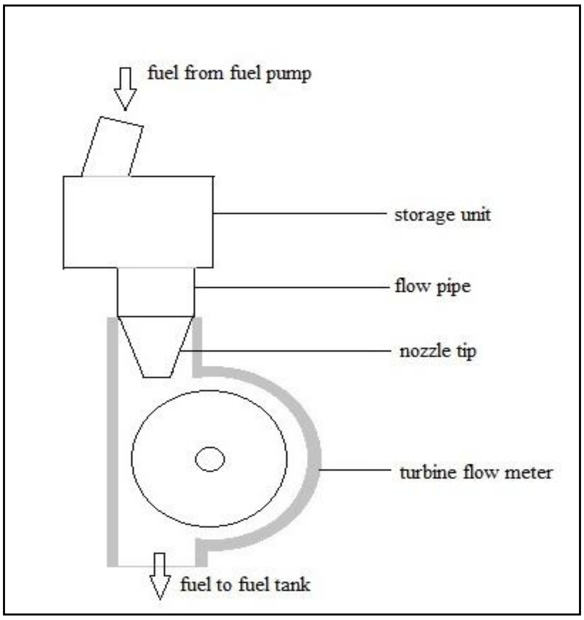

Fig 4: Flow pipe (Storage unit and short pipe with nozzle) attached to turbine flow meter

Calibration results:

Measured quantity (ml)	Calibrated quantity (ml)	Error (ml)
400	400	000
500	499	001

Usage of storage unit provided constant flow, resulting in negligible calibration error.

IV. CONCLUSION

Turbine flow meter was attached to different design of flow pipe (entry end of flow meter), such as long flow pipe, short flow pipe, short pipe with nozzle tip and flow pipe with storage unit (with short pipe and nozzle tip).

Analysing the various test results, as discussed in testing section, trail 4: flow of fuel on to the flow meter through storage unit, short pipe and nozzle gave accurate calibration results.

REFERENCES

[1] A. Avinash Kumar, U. Singaravelan, " Digital fuel level indicator in two wheeler along with distance to zero indicator", IOSR Journal of Mechanical and Civil Engineering, Vol. 11, Issue 2 PP 80-84, April 2014.

[2] J. Vignesh, V. Nijanthan, " Digital fuel level indicator for motor bikes using arduino microcontroller", SSRG Journal of Electronics and Communication Engineering, Vol. 4, Issue 3, March 2017.

[3] Mandar Milind Gijre, Arjun Mane, " Smart fuel level indication system", Global research and development journal for Engineering, Vol. 2, Issue 6, May 2017.

[4] Choudhary Saurabh, Barapatre Shubham, " Smart digital fuel indicator system", International Engineering Research Journal, Vol. 2, Issue 9, PP 3552-3554, 2017.

[5] Sayyed Junaid, Tushar Dhood, " A paper on installation and testing of alphanumeric fuel indicator system", International Journal of Research in Advent Technology, Vol. 2, Issue 4, April 2014.

[6] Shakib Javed S. Sheikh, Sumit D. Chambhare, " Development and fabrication of alphanumeric fuel level indicator for two wheelers", International Journal of Research in Advent Technology, Vol. 2, Issue 4, April 2014.