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"THE QUALITY AND QUANTITY TESTING OF GASOLINE FUEL USING SENSING METHOD"

Mr. Prashant S. Daingade[1], Mr. Aniket S. Patil[2], Mr. Dhirajkumar B. Nikam[3], Mr. Mangesh R. Rokade[4], Mr. Suraj S. Kharade[5], Mr. Ajinkya J. More[6],

[1]Assistant Professor, ADCET, ASHTA, Maharashtra, India.
[23456]B.E. Students, ADCET, ASHTA, Maharashtra, India.

Abstract-Petrol is obtained from decomposition living organisms. Petrol is homogeneous mixture of hydrogen and carbon. Petrol is a volatile liquid. Itis also known as gasoline which consists of C4 to C12 hydrocarbons. It is a toxic, highly inflammable liquid so, it is used as a fuel in internal combustion engines. It consists mainly organic compounds obtained by the fractional distillation of petroleum, with a variety of ingredients to increase various performance features related to the satisfactory operation of engines as well as to decrease fuel handling storage. Gasoline or petrol is a majorly used fuel in India for automobiles. Adulteration of fuel at this point of sale or during transportation has become very major problem in countries like India. Adding ingredients having low tax or kerosene to petrol which increases engine deposits and emissions also leads engine maintenance. This will lead to loss of government annual revenue is unlikely to have adverse environmental impacts. This project will help us to know real time quality and quantity of gasoline fuel.

Keywords-Quality and Quantity of gasoline fuel

1. INTRODUCTION

Quantity of fuel delivered to the customer at petrol pump has become a trust issue, customer is cheated frequently as he is totally dependent on the server. There is need to create a system to assure the customer about quality and quantity of fuel. Most of the vehicles have analog indication about the fuel, they just give an idea about the fuel left or we can say that they told us when to visit the petrol pump for next fueling. They do not help us to calculate the new additional amount of fuel entered in the tank. There are some issues traditional stamping or drawing processes. Nevertheless, the process still needs a further optimization to guarantee the reliability required for regarding the existing technology of fuel measurement so our try to develop a better method to check the exact quantity of fuel. Here the total focus is to develop a meter which can measure the amount of new fuel added to the tank.

2. PRINCIPLE OF OPERATION:

2.1 Quantity checking:

The system consists Ultrasonic Sensor, LCD to show the output. The system is controlled by using Arduino. Ultrasonic sensor shaving low cost and the possibility to use in any environment. This sensor can measure a distance within 0.003-3 meter effectively and transform the data into impulse of different width. By using this pulse width, fuel level in tank can measured. Fuel quantity measurement system is as shown in following block diagram.

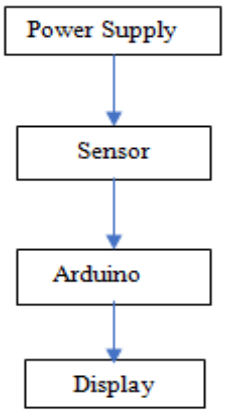


Fig 1: Fuel Quantity measurement system

The whole block diagram consists of following parts

a) Power Supply

b) Sensors

c) Arduino controller

d) Display

A. Power Supply: 5V supply given at the input.

B. Arduino: Arduino consists of both a physical programmable circuit board that runs on your computer, used to write and upload programs to the physical board.

C. sensor: It is a type of trans receiver. Ultrasonic sensor works on the principle of echo. The ultrasonic waves are sent to an object and the reflected waves are received. Time required for the reflected waves is recorded and accordingly the distance is calculated by knowing the speed of transmitted waves. This principle is used here.

D. Display: Display units shows the amount of fuel digitally.

2.2 Quality checking

Adulteration defined as the introduction of a foreign substance into motor spirit / high speed diesel/petrol, unauthorized with the result that the product does not conform to the requirements and specifications of the product Petrol, kerosene and high speed diesel is a mixture of organic volatile compounds, mainly hydrocarbons (83-87% of carbon and 11-15% of hydrogen).The petroleum fraction for petrol, kerosene and diesel Over the past it is seen that different methods and standards involving determination of physical and chemical properties are carried out for detection of adulterated petroleum products. As adulteration occurs mainly at some point of product delivery between refineries and fuel stations. The American Society for Testing and Materials International (ASTM International) has developed and documented test methods for its detection including petroleum products. But such methods endure from limitations in terms of accuracy and sensitivity. Although different tests namely Density test, Evaporation test, Distillation test, Chemical test may be used to determine the adulteration.

Table 1: Density variation

Petrol/Petrol + Kerosene	Density 26^0 C
Pure petrol	719
Up to 5%	725
Up to 20%	751
Up to 21-30%	768
Up to 31-40%	774
Up to 41-50%	783
Up to 51-55 %	791
Up to 56-60%	802
10% adulterated	725
20% adulterated	783
Kerosene	795

The Parameters like density, Distillation, Hydrocarbon Composition Stability Octane Number, Multifunctional additive dosage are conducted for Gasoline. We are going to identify the adulteration by checking the density. Density according to the percentage of adulteration is shown in table above. The table gives information about the density of petrol at respective percentage adulteration of kerosene with the petrol on basis of this table we can identify the quality of adulteration into the petrol.

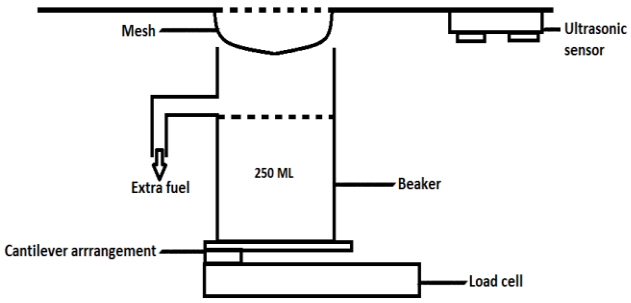


Fig2. Setup for density testing of gasoline fuel

The setup consists of 200ml Beaker having mesh on upper side. The electronic flow valve is attached at bottom of beaker, so that the fuel from beaker is released using gravitational force. The whole arrangement is placed on load cell. The load cell and the electronic flow valve are connected to Arduino and are controlled using program.

2.3 Working:

The system is capable of performing two operations:

1) Measuring quantity of fuel in tank
2) Quality of newly added fuel

2.4 Operation:

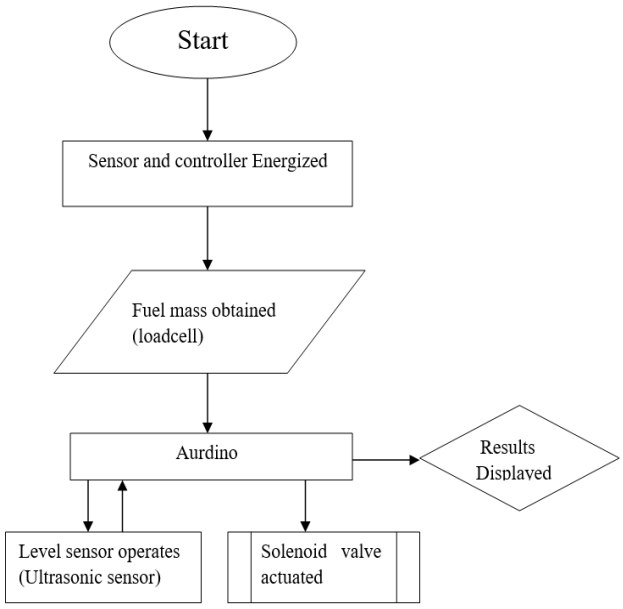
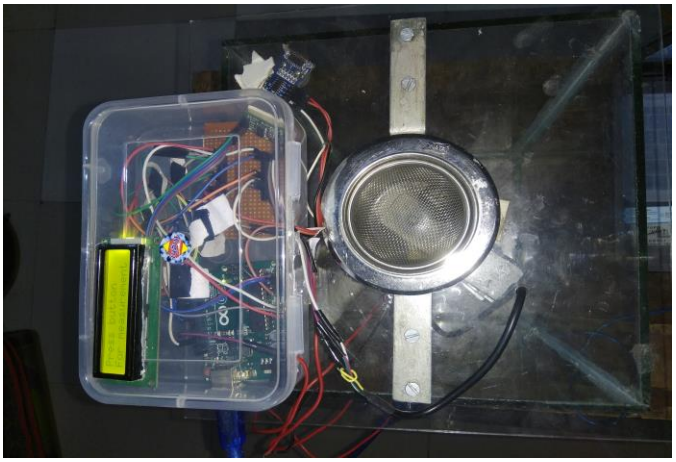


Fig 3. Operation Flow Chart

The fuel is poured into the tank from the opening at top of tank fuel falls into the measuring beaker through the mesh.



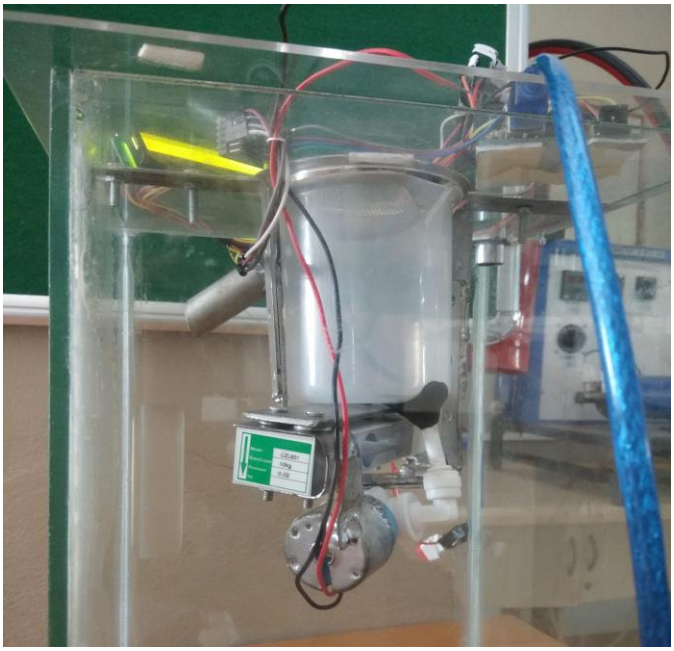


Fig 4: Setup for density testing of gasoline fuel.

The mesh avoids splashing of fuel and also creates obstruction for evaporating fuel. The measuring beaker fills up to 250 ml and the remaining fuel overflows opening into the tank. Weight of fuel (250 ml) inside the beaker is measured by the load cell situated below the beaker. This data is sent to Arduino controller. Thus, by the relation,

$$Density = \frac{mass}{volume}$$

The density of fuel is determined, based on the density calculated the adulteration in fuel is checked and density of fuel displayed on display. The fuel from beaker is passed out from bottom outlet of fuel in beaker eventually total fuel poured gets collected into the tank at bottom. The level of fuel in tanks thus increases. This variation in height of fuel level is detected by ultrasonic sensor. It can be given by,

$$L = 1/2 \times D \times C$$

Depending upon the data obtained by the ultrasonic sensor, the exact quantity of poured fuel is measured and displayed on display.

3. Components Included

3.1. Arduino:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input or output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

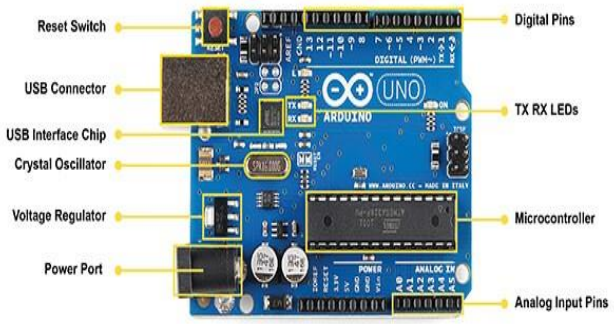


Fig 5: Arduino Uno

3.2. Ultrasonic sensor:

An Ultrasonic sensor is a device that can measure the distance of an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and by receiving the reflected sound wave. The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect

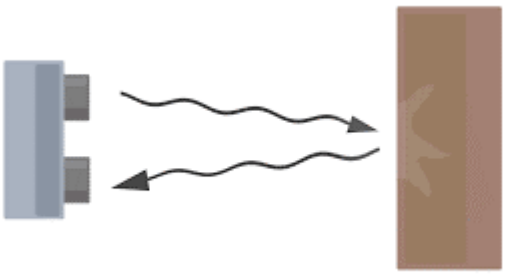


Fig 6: Ultrasonic Wave Formation

back. The sensor has two openings on its front. One opening transmits ultrasonic waves, the other receives them. The distance can be calculated with the following formula:

$$L = 1/2 \times T \times C$$

Where, L-Distance

T-Time between the emission and reception

C- The sonic speed.

C=331.5+0.607t (m/s)

Where, T-Temperature

(The value is multiplied by 1/2 because, T is the time for go and return distance)

3.2.1 Working of ultrasonic sensor:

• STEP-1: Make 'TRIGGER' pin of sensor high for some duration. This will initiate sensor cycle.

• STEP-2: Eight pulses of 40 KHz are transmitted from transmitter part of sensor. After this is done, 'ECHO' pin goes high from low state

• STEP-3: After the transmission, transmitted signal gets reflected from the nearby object and returns back to the sensor.

• STEP-4: When the ultrasonic sensor detects reflected wave, 'ECHO' pin of sensor goes low.

• STEP-5: The time duration when ECHO pin is high will provide distance between sensor and detected object.

• STEP-6: The ultrasonic sensor is programmed in such a way that if no object is found then ECHO pin remains high for some time and will go low again.

3.3 HX711 Load Cell Amplifier:

In this Arduino tutorial of HX711 Load Cell amplifier interface. We are interfacing 40Kg load cell to the Arduino using HX711 Load cell amplifier module. HX711 is a precision 24-bit analog to digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor. There is no programming needed for the internal registers. All controls to the HX711 are through the pins. Most Load cell have four wires red, black, green and white. On HX711 board you will find E+, E-, A+, A- and B+, B- connections.

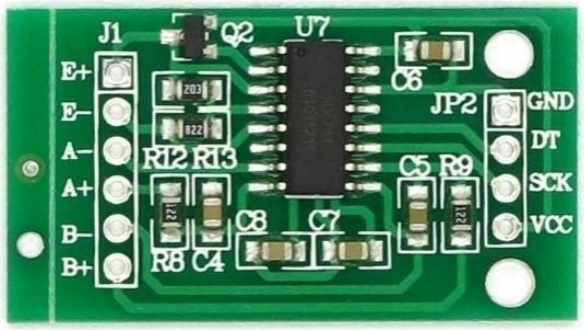


Fig 7: Diagram HX711

3.4 Load Cell

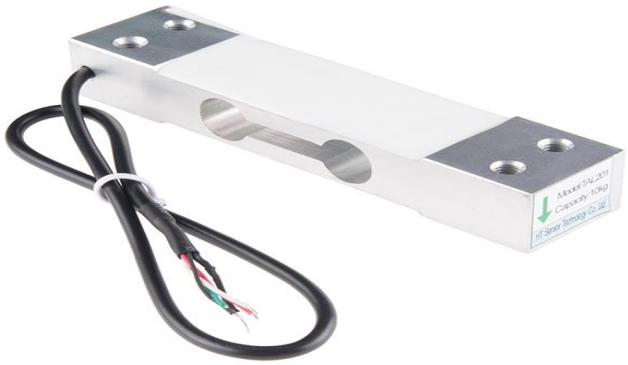


Fig 8: Load Cell

A load cell is made by using an elastic member (with very highly repeatable deflection pattern) to which a number of strain gauges are attached. A strain gauge is a bonded resistive foil sensor whose resistance changes with applied force. Out load cell and force sensor typically use four strain gauges arranged in a Wheatstone Bridge. Strain gauge load cells are the most common in industry. These load cells are particularly stiff, have very good resonance values, and tend to have long life cycles in application. Strain gauge load cells work on the principle that the strain gauge deforms when the material of the load cells deforms appropriately. Deformation of the strain gauge changes its electrical resistance, by an amount that is proportional to the strain. The change in resistance of the strain gauge provides an electrical value change that is calibrated to the load placed on the load cell.

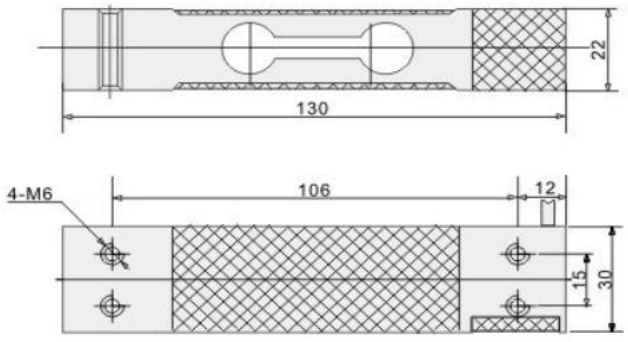


Fig 9: Dimension of Load Cell

3.4.1Wiring for load cell:

The full-bridge cells come typically in four-wire configuration. The wires to the top and bottom end of the bridge are the excitation (often labelled E+ and E−, or Ex+ and Ex−), the wires to its sides are the signal (labelled S+ and S−). Ideally, the voltage difference between S+ and S− is zero under zero load, and grows proportionally to the load cell's mechanical

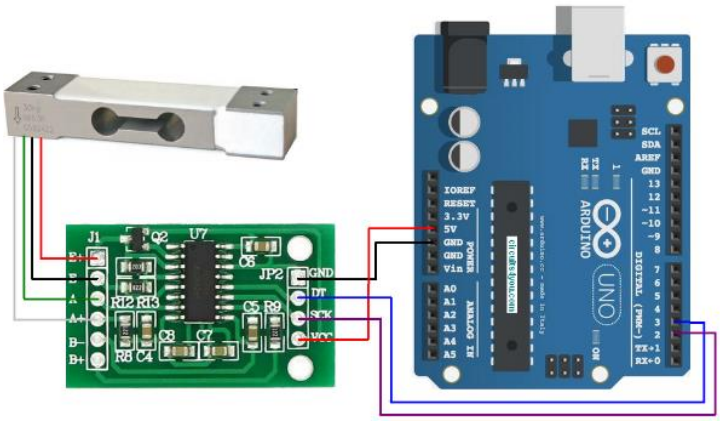


Fig 10: Loadcell Arduino connection diagram

3.5 Solenoid valve:

The core or plunger is the magnetic component that moves when the solenoid is energized. The core is coaxial with the solenoid. The core's movement will make or break the seals that control the movement of the fluid. When the coil is not energized, springs will hold the core in its normal position. The core tube contains and guides the core. It also retains the plug nut and may seal the fluid. An O-ring seal between the tube and the plug nut will prevent the fluid from escaping. The solenoid coil consists of many turns of copper wire that surround the core tube and induce the movement of the core. The coil is often encapsulated in epoxy. The coil also has an iron frame that provides a low magnetic path resistance.

Fig 11: Solenoid valve

4. Result

1. For Quantity checkup

Data obtained by the ultrasonic sensor, the exact quantity of poured fuel is measured and displayed on display. The amount of fuel measured in tank is 90-95% accurate.

2. For Quality checkup

According to the percentage of adulteration is shown in table above. The table gives information about the density of petrol at respective percentage adulteration

From this table we can identify the quality of adulteration into the petrol.

Table 2: Test Results of Adulteration.

Petrol/Petrol + Kerosene	Density
Pure Petrol	718-722
Petrol+ 10% Adulteration	730-735
Petrol+ 20% Adulteration	738-742
Kerosene	798-802

5. Conclusion:

Irrespective of the challenges encountered, we able to measure the pumped fuel inside the tank using ultrasonic sensor. The ultrasonic sensor also gives the quantity of fuel remaining in the tank.The accuracy of quality and quantity measurement system is about 90-95%. After brainstorming and researching we came to an agreement that the system is best solution for quality and quantity measurement at fuel station as well as in automobile industry.

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BIOGRAPHIES

Mr. Prashant S. Daingade
Assistant professor in Mechanical Department at Annasaheb Dange college of engineering and technology, Ashta.

Mr. Aniket S. Patil.
B.E Mechanical Engineering
Annasaheb Dange College of Engineering and Technology
Ashta, Maharashtra, India.

Mr. Dhirajkumar B. Nikam.
B.E Mechanical Engineering
Annasaheb Dange College of Engineering and Technology Ashta, Maharashtra, India.

Mr. Mangesh R. Rokade.
B.E Mechanical Engineering
Annasaheb Dange College of Engineering and Technology Ashta, Maharashtra, India.

Mr. Suraj S. Kharade.
B.E Mechanical Engineering
Annasaheb Dange College of Engineering and Technology Ashta, Maharashtra, India.

Mr. Ajinkya J. More.
B.E Mechanical Engineering
Annasaheb Dange College of Engineering and Technology Ashta, Maharashtra, India.