FUEL MEASUREMENT USING LOADCELL

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Abstract - *The utilization of vehicles is rapidly increasing now a days and it leads to a huge problem of fuel availability. Often humans forgot to check the fuel level before taking vehicles and it will run out of fuel in half a way. All petrol and diesel filling bunks have digital displays to indicate the amount of fuel added. The users don't know whether it is showing the accurate value or not. To overcome this problem, this paper suggests a load cell based fuel measurement which gives exact level of fuel while fuel filling process and also in the travelling time. Nonstop monitoring of fuel level is attained by attaching the load cell below the fuel tank with the use of arduino Uno and display unit fixed with dash board. The current speed of vehicle is indicated by the speedometer which is arranged with arduino and it also calculates the mileage which helps the vehicle user to know about the remaining kilometers of vehicle will pass through based on current speed with the available fuel. The measured fuel levels can be sent through GSM module to the owners of the hiring vehicles by messages through electronic gadgets for their verification purposes. By interfacing GPS module with arduino board it can show the vehicle's position with help of satellites.*

Key Words: Load cell, Arduino, Fuel density.

1. INTRODUCTION

The digital fuel indicating system already exists in four wheeler but only few attempts have been made in two wheelers. The first digital fuel indicating system in India was Vanav digital fuel indicator [1].The remaining fuel in the fuel tank is displayed in the indicator of the four wheelers. Speed and fuel are measured in kilometer/hour and liters. The analog indicator system cannot give this kind of information in accurate manner. By using the digital circuit, users are able to identify the correct amount of fuel added in bunk and it helps to know the mileage of the vehicle. We are regularly facing the petrol bunk frauds knowingly or unknowingly and it leads to corruption everywhere [1]. The customers pay the right amount to fuel quantity but they were cheated by the bunk owners. The fuel added is not accurate and it has a difference between the displayed fuel values to the added quantity. Every customer has their rights to ask for a precise quantity and digital display helps them.

2. HARDWARE DESCRIPTION

2.1 Load Cell

Several methods are available for fuel level detection but in this paper a precise measurement is proposed to detect the fuel level accurately. It is a transducer with strain gauge that measures the weight of fuel tank based on the force applied and it has a bridge circuit to convert the change in resistance to electrical signals. It is converted by four strain gauges inside the load cell which forms the wheat stone bridge circuit. The output electrical signals are send to the arduino Uno and it is fixed below the fuel tank. The load cell is chosen based upon the capacity of fuel tank as it is different for two wheelers and four wheelers. Further, different brands of two wheelers and four wheelers fuel tank capacity varies considerably. The proposed work is an efficient method to monitor the amount of fuel in the fuel tank.

2.2 Arduino Uno

Arduino is an open source project with both hardware and software for an interactive environment with physical world. Arduino Uno is a microcontroller works on ATmega328 and it provides a set of analog and digital pins which is used for interfacing. The output signals from the load cell are given to the arduino Uno that converts the weight value into litres. The arduino is coded for this conversion and it is connected with display unit to show the values in liters. This conversion can be done by using some formulae and it depends on fuel density and it differs for all fuels. Many processors can be used in the replace of arduino.

2.3 GSM Modem

Global system for mobile communications is a digital system that uses variation of time division multiple access (TDMA) technology. It is used for communication purpose to send messages. The GSM modem transmits the measured fuel levels while filling of fuel tank to the respective owners. GSM modem accepts any sim and it will operate like a mobile phone.

2.4 Speedometer

A speedometer or a speed meter measures angular velocity. It measures and displays the instantaneous speed of a vehicle. It also indicates the remaining kilometers that vehicle will run with the remaining fuel available in the tank.

3. PROPOSED METHOD

The proposed method is a best alternative to fuel measurement techniques to help the users with low cost and requirements. It is an efficient one and also applicable in all types of vehicles. Fig.1 demonstrates the overview of system configuration.
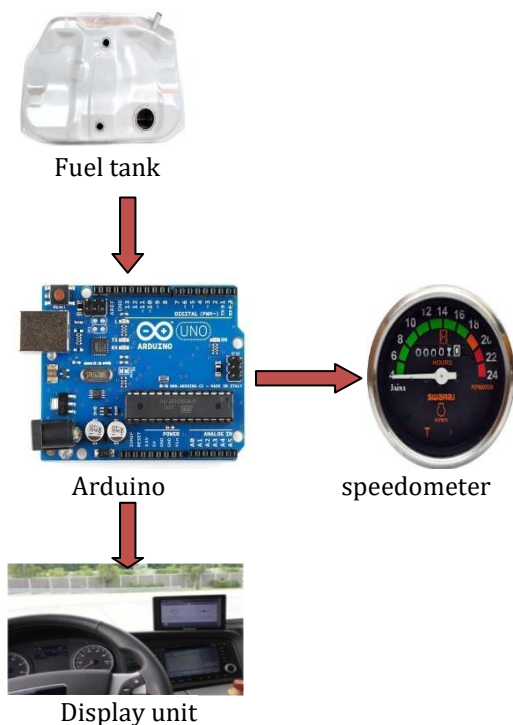

Fig-1: Overview of system configuration

This system can overcome the demerits of existed system and give accurate values to the users. Instead of using fuel sensors to detect the fuel level, here load cell is used. The block diagram of given system is shown in fig.2. The load cell is attached with base of fuel tank and measures the weight of tank. These values are given to arduino and it converts weight values into liters. The respective fuel added at petrol bunk and remaining fuel will be displayed in display unit. The vehicle user can get correct quantity of fuel for their paid amount.

Identically the speedometer will measure the speed of vehicle and remaining kilometers run with remaining fuel. GPS can send specific location of the vehicle and GSM alerts the owner in case of any emergency.
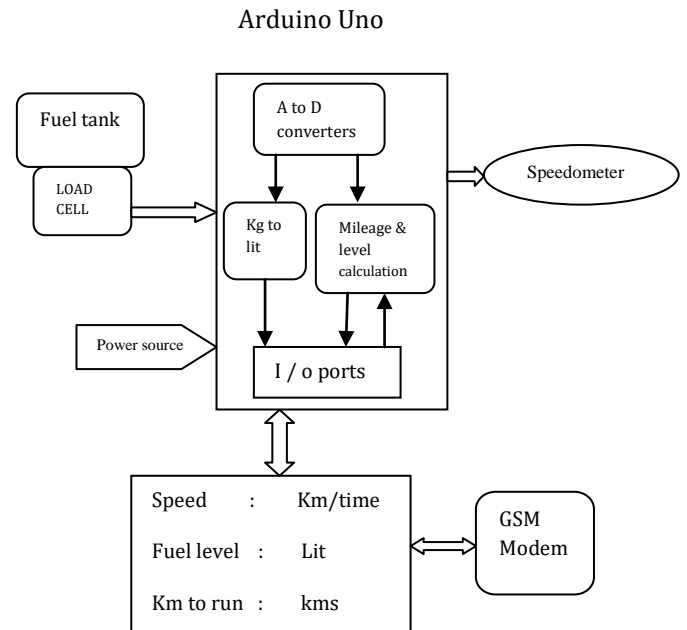

Fig-2: Block diagram of given system

4. LEVEL CALCULATIONS

Level conversion takes place in arduino by some formula to calculate the accurate fuel level. Density values differ for various fuels and also with temperature. The unit of fuel density is expressed in kilograms per cubic meter [1]. Fuel level calculation is based upon fuel density values. Molecular weight is proportional to fuel density and it commonly increases with rising molecular weight of fuel and energy density values are tabulated as shown in the table 1.

Type of Fuel	Energy Density	Energy Density
	$(MJKg^{-1})$	$(MJlitre^{-1})$
Petrol	46	34
Diesel	45	38

Table-1: Values of fuel density

Fuel density also normally rises with increasing molecular weight of the component atoms of the fuel molecules. Fuel density is used to find fuel volume ratio, which is successively used to calculate the tank mass. Hence by considering the

Fuel density, the calculation was made by the coming formula [1].

Fuel volume ratio= (Fuel Mass Ratio) / Fuel density

Tank mass= (Tank pressure * 3.0) /
(Effective tensile * X)

Where,

X= (Fuel Ratio + Oxidizer Ratio +
Propellant Ratio)
(Consider all ratios in Volume)

5. SPEED MEASUREMENTS

Speed measurement is another criterion of the fuel level measurement ant it mainly depends on the mileage of that specific vehicle. If the mileage of vehicle is 15km/liter, that vehicle is running with average speed, this gives the correct distance with existing fuel. If speed exceeds beyond average speed, the kilometers to run will falls with mileage.

6. CONCLUSION

The proposed idea of fuel measurement using load cell with arduino is very cost efficient and easy to use. It may be enhanced with any microcontrollers and can be implemented in all types of vehicles. By using this method petrol bunk frauds can be avoided. This project can be enhanced by interfacing GPS with arduino to track vehicle's location in case of any emergency situations.

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