Smart Fuel Level Indication System

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Abstract

In the recent times we are constantly hearing about petrol bunk frauds. Most of the petrol bunks today have manipulated 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. I.et 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 focus on creating a digital display of the exact amount of fuel contained in the vehicles tank and also helps in cross checking the quantity of fuel filled at the petrol bunk. In addition to this the project also tends to find the mileage of the bike which is a time consuming and tedious job to do manually by noting down the readings all the time and the proposed system will also show the nearest petrol pump using GPS when the fuel tank goes in reserve mode.

Keywords- GPS, Hall Effect, Proteus, Ultrasonic Sensor, Serial Transmission

I. INTRODUCTION

Today in this digitized world, if the fuel indicator in the automobiles is also made digital it will help to know the exact amount of fuel available in the fuel tank. The above furnished fact is considered in our project and we found out a proper solution for indicating the exact availability of fuel in the tank digitally. Here, we are indicating the amount of fuel in the tank in litres. This value in litres will be in numerical digits (ex: 1.2, 1.3 and 1.4). This project mainly concentrates about the indication of fuel level in two- wheeler tanks. Various other features like the distance that 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. This project helps to avoid a lot of problems like fuel bunks at fuel stations, fuel theft and prevents us from getting into situations where we have to push our vehicles due to assumptions of the level of fuel. Nowadays the fuel indicator system for the two wheelers are digital but they do not display the exact amount of fuel which is present in the tank i.e. they show the amount of fuel in terms of bars and not in numbers or digits like Litre or Millilitre. 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 Litres(L) or Millilitres (ml). In this project we first surveyed the existing fuel indicator systems and fuel tanks of different bikes and scooters. During this survey we examined that the shape of the fuel tanks is in irregular fashion. But due to irregular shape of the tanks there were much complexities arising for the installation of electronics kit and level sensors which are used for calibration of fuel amount. Hence we have taken all the constraints into consideration and prepared a project to address all the problems stated above and found an appropriate solution to it. The fuel level indicator can be used for any type of fluid and the level is automatically detected by weighing Mass of the liquid by pressure sensor and displaying the output on LCD.

II. LITERATURE SURVEY

Until now the accuracy of the fuel level measurement has not been of great importance. The purpose measuring the fuel level has been to present the information on the dashboard with a fuel level meter. Instead of accuracy the two most important things have been to avoid rapid changes in the fuel level displayed and the meter must indicate that the tank is empty when the fuel level is below a predefined level. This system is not capable to provide the exact value of fuel in the fuel tank. Also such system cannot protect us from getting cheated at petrol pumps and these costs more for less amount of fuel so filled. So it becomes necessary to develop such a system which gives exact (numeric) value of fuel in fuel tank. Mainly there are four fuel measuring techniques.

A. Fuel Gauge

A gauge (or gas gauge) is an instrument used to indicate the level of fuel contained in a tank. Commonly used in cars, it may also be used for any tank including underground storage tanks. The system consists of two important part that is for sensing and indication of fuel level. The sensing unit usually uses a float type sensor to measure fuel level while the indicator system measures the amount of electric current flowing through the sensing unit and indicates fuel level.
There are various techniques to implement sensing and indicating systems.

- Traditional float type measurement technique
- Microcontroller based fuel measurement technique

B. Various Techniques used for Sensing and Indicating

1) Resistive Float Type

Presently the most common and traditional fuel indicator system makes use of the resistive float type sensors to measure the level of fuel in the tank and this system consists of two units i.e. the sender unit responsible to measure the level of fuel in the tank, the gauge until responsible to display the measured fuel level to the driver. Another technique is known as the Smart fuel gauge system, which is similar to the traditional technique but also makes use of embedded systems such as microcontrollers or microprocessors for providing better accuracy.

2) Operating Principle

The traditional fuel indicator consists of two units i.e. the sending unit and the gauge. The Fig 2.1 shows the commonly used traditional fuel measurement system. The sending unit is located in the fuel tank of the car and it consists of a float, usually made of foam, connected to a thin, metal rod. The end of the metal rod is mounted on a variable resister or potentiometer. The variable resistor consists of a strip of resistive material over it which moves across the variable resistor changing the resistance and flow of current depending on the movement of the float with respect to the level of fuel present in the fuel tank. The Fig: 2.1 shows that the fuel in the fuel tank is almost empty and the float has moved to the bottom of the tank moving the strip on the resistor thus increasing the resistance to maximum and current flow through the resistor becomes minimum thus displaying fuel empty on the gauge. The gauge consists of a bimetallic strip i.e. a strip made of different kinds of metal and whose thermal co-efficient of expansion differs from each other. When resistance is decreases current increases and thus the strip is heated during which one metal expands less than the other, so the strip curves and this bending action is what moves the needle move on the fuel gauge. As resistance increases, less current passes through the heating coil, so the bimetallic strip cools. As the strip cools, it straightens out, pulling the gauge from full to empty.

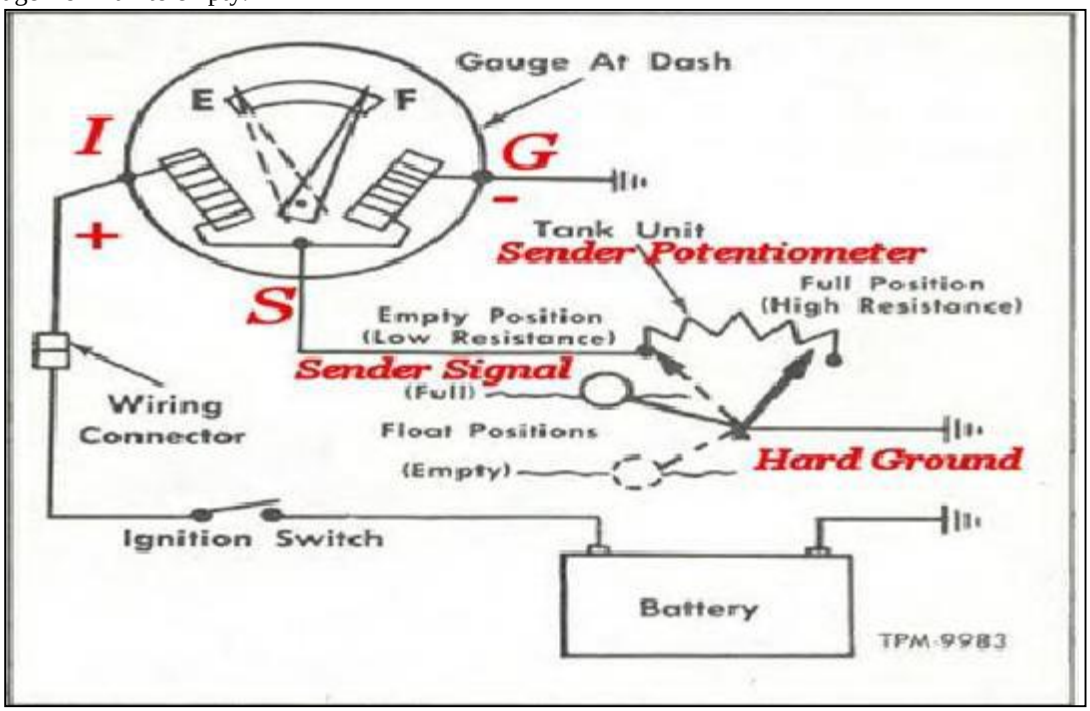

Fig. 1: Resistive float working

3) Capacitance Level Sensing:

In a capacitive fuel level sensing system, the capacitive sensors have two conducting terminals electrodes and the gap between the two rods is fixed the fuel level can be found by measuring the capacitance between the two conductors immersed into the fuel as shown in the figure given below:

Since the capacitance is directly proportional to the dielectric constant between the parallel rods or plates, therefore the fuel rising between the two parallel rods leads to increase or change in the net capacitance value of the measuring tank as a function of fluid height. If the dielectric behaves even slightly as a conductor, then this can reduce the performance of the capacitor. The dielectric material used should ideally be an insulator while chemically fuel will have other contents mixed in it increasing the conductivity of electrons to some extent, therefore a common method used to overcome this problem is placing an insulating layer on each of the rods in order to preserve the performance of the measuring system. Capacitive type fuel level measurement system can make use of multiple capacitors or multi-plate capacitors which has an advantage of an increased capacitance value and accuracy. Multi capacitor systems share the common dielectric constant, which is essentially the fluid itself in capacitive type fluid level measurement systems. If a capacitor is constructed with 'n' number of parallel plates, then the overall capacitance will be increased by a factor of (n-1).

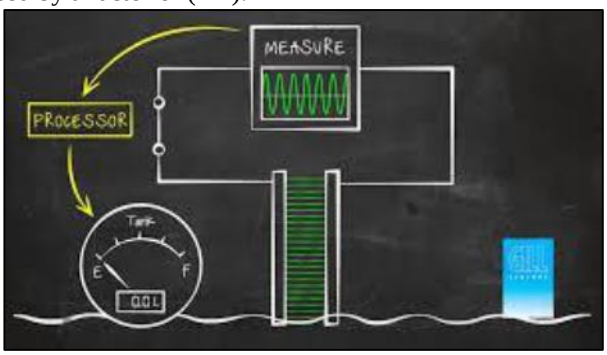

Fig. 2 (a): Capacitive load

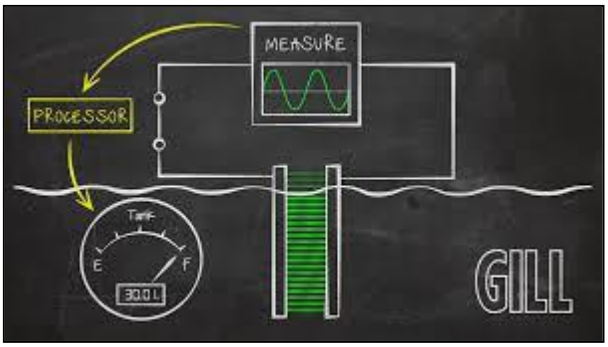

Fig. 2 (b): Capacitive load with fuel

III. METHODOLOGY IN PROPOSED SYSTEM

The proposed system aim in the measurement of the fuel in the vehicle tank using ultrasonic sensor. The ultrasonic sensor has a better accuracy and and it is easy to calibrate and interface it with arduino controller which is used. The ultrasonic sensor sends ultrasonic waves and reflects it back to the receiver unit of the ultrasonic sensor. In this way we can find the level of fuel in the tank if we know the time required by the ultrasonic sensor to travel. We have used aurdino because it is more reliable than 8051 controller. In addition to this we have used Hall Effect sensor which can calculate the mileage of the vehicle. The Hall Effect sensor will count the number of rotations done by the wheel and accordingly it will calculate the mileage of the vehicle. And when the vehicle tank goes in reserve mode the GPS will indicate the nearby petrol pump in the prescribed area.

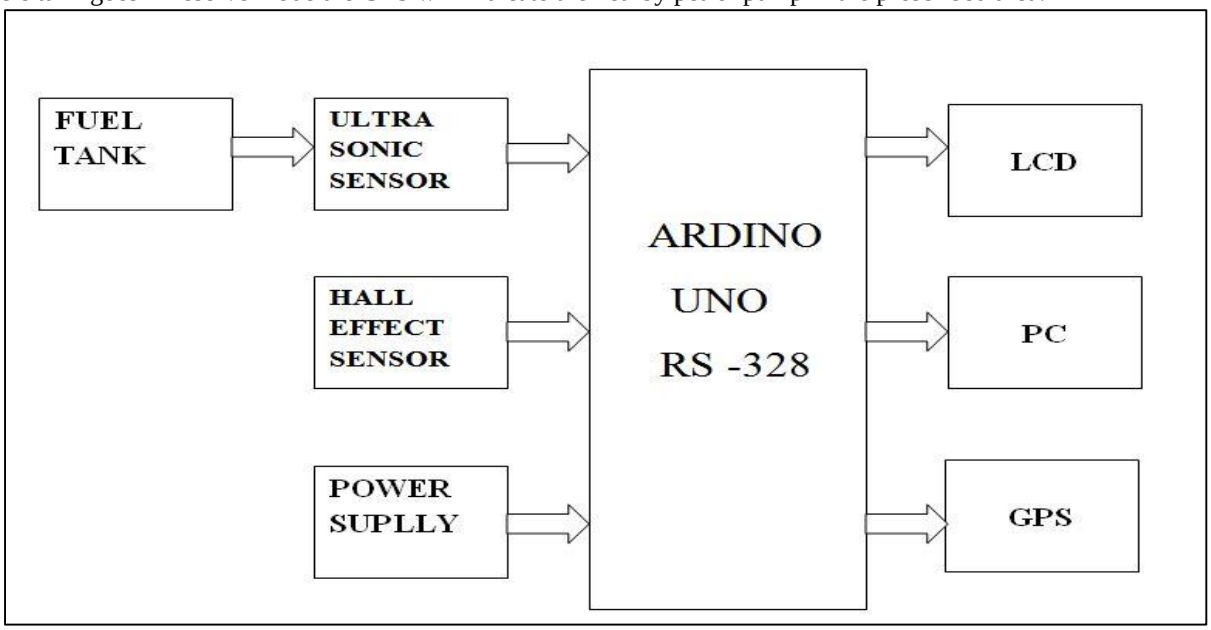

Fig. 3: Block Diagram

The ultrasonic sensor is directly connected to the fuel tank of the vehicle. Accordingly the ultrasonic sensor will find the output that is the level of fuel in tank in litres. The Hall Effect sensor is connected to the wheel of the vehicle with magnet on one of the spoke of the vehicle. So it will easily calculate the number of rotations easily. And the distance covered can be easily calculated by knowing the rotations.

IV. RESULTS

A. Simulation Results

The simulation of the system was carried out separately on each module in proteus simulation environment.

1) Ultrasoni Sensor Simulation

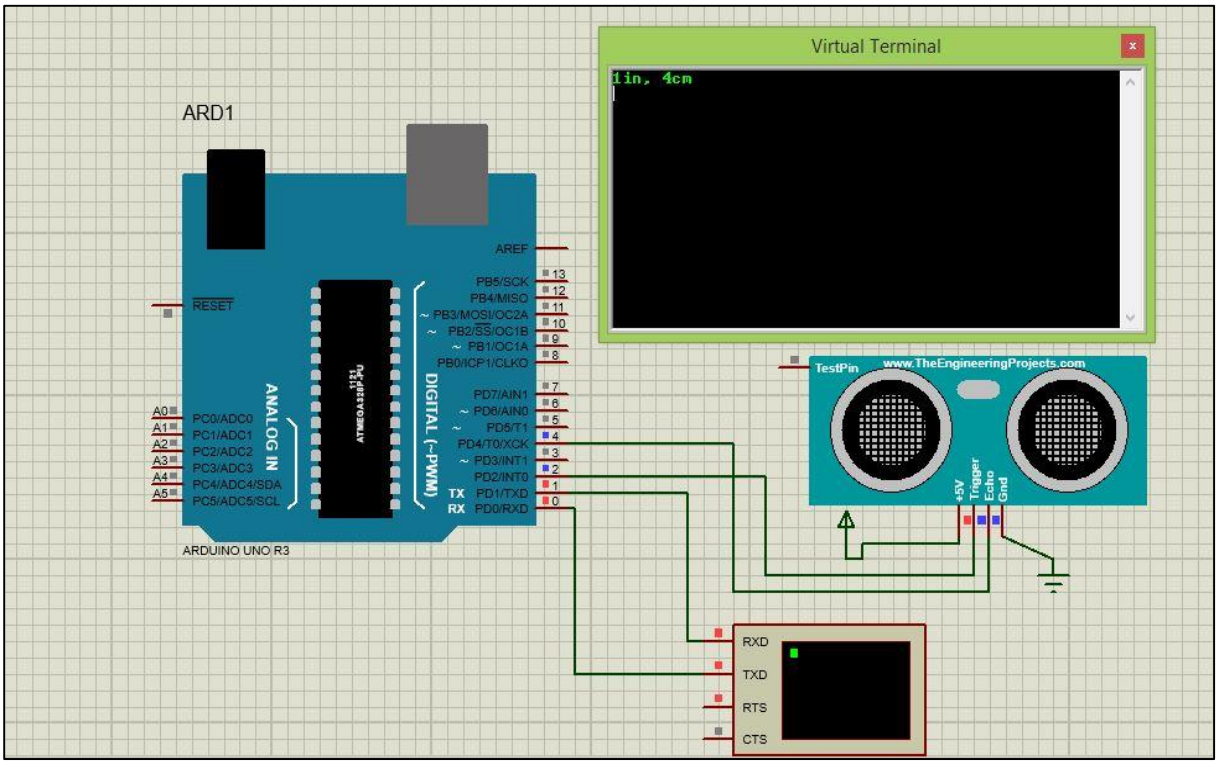

Fig. 4: Ultrasonic Sensor simulation

2) GPS Module Simulation

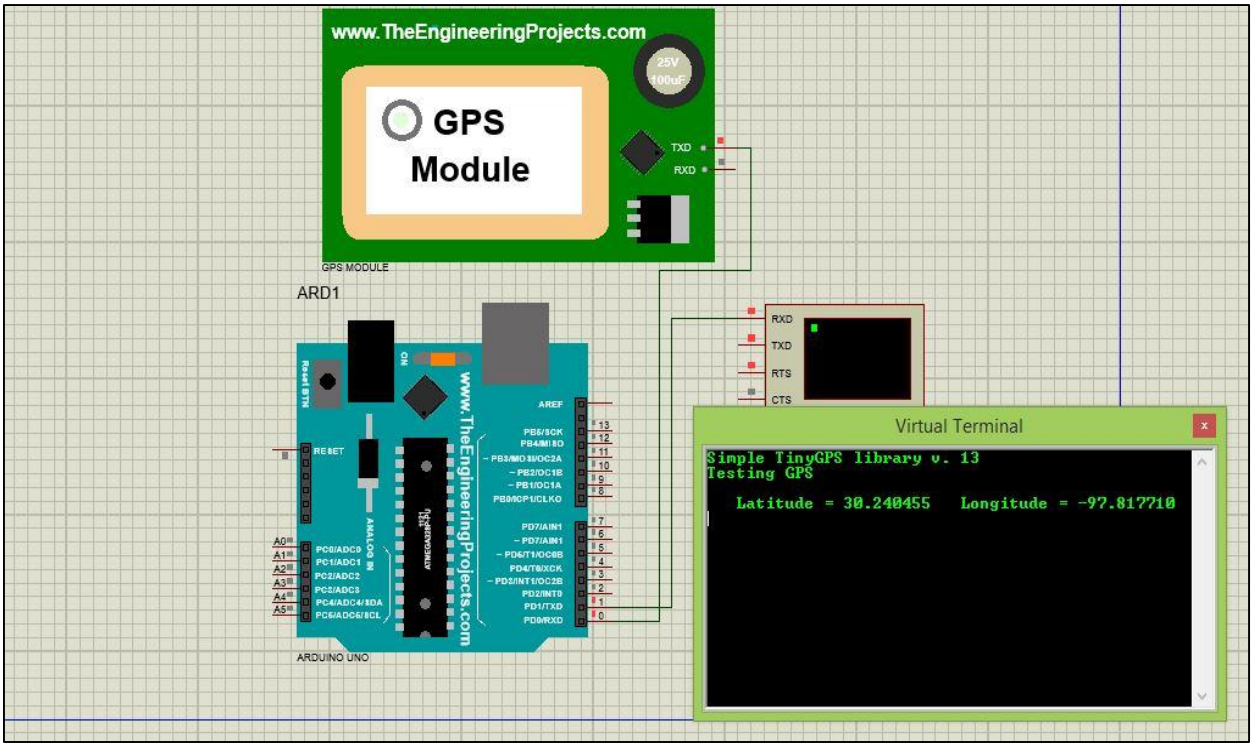

Fig. 5: GPS Simulation

B. Actual Hardware

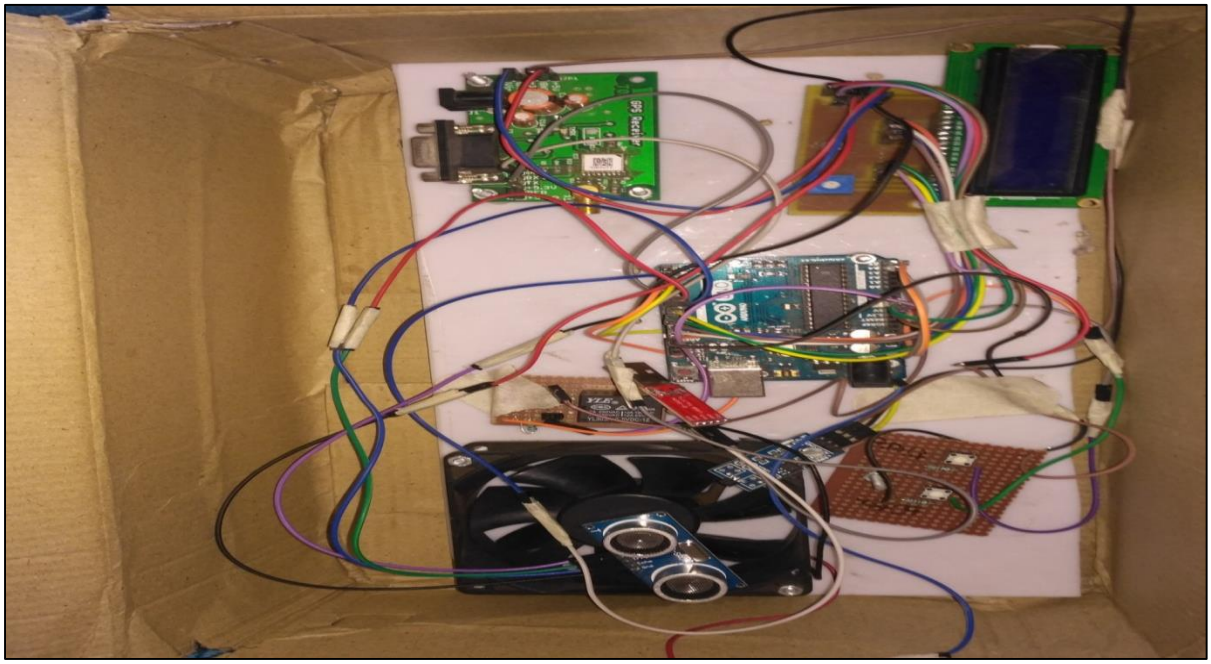

Fig. 6: Actual Hardware

V. CONCLUSIONS

The smart digital fuel indicator is very advance type indicating system. The main advantage of this system is that it can gives accurate value of remaining fuel as well as the vehicle running capacity in km. The accuracy level is estimated to be up to 70% to 75% because of advance type C.P.U is preferred and used in this project. The operation time taken is very less in micro seconds. All the equipment's have long life, durable & quality material.

This project is able to show that simple available hardware and technology can be used to construct a robust fuel level monitoring system. The system designed and tested in this project presented at the low construction cost of the system.
Involving mechatronics in such design applications can eventually solve many practical problems with ease, reliability and at low cost.

Even though the quality of material used and components used are of good quality, the cost of the project is not so costly and it can be used and implemented in all vehicles without much increment of cost of the vehicle. This smart fuel indicator is best in its field and will be most widely used and advance system in future.

As its operation is dependent on the pressure sensor's accuracy and in case of sensor failure, the operation of the indicator system will be disturbed. These are the limitation of the smart digital fuel indicator system. But despite of this limitation this device can be a most advance and accurate gauge indicator in future.

ACKNOWLEDGMENT

Our deepest thanks to Lecturer, Prof. S. A. Gandhi, the guide of the project for guiding and correcting various documents of our project with attention and care. She has taken pain to go through the project and make necessary correction as and when needed. We also would like to thank Head of Department and Project Co-ordinator, Prof S.I.Nipanikar without him the project would have been a distant reality. We also would also extend our heartfelt thanks to Prof.C. M. Sedani for his support.

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