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Digital Fuel Level Indicator system

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Abstract: *In today's rapidly changing world and rise in demand of fuel especially in developing nation we perpetually hear about the increasing fuel prices. This topic has become a major issue. As the increasing demand and increase prices there has been need to developed a digital fuel indicator to know the better about the fuel present and added to the vehicle. Fuel theft by petrol pump owner is also leading the common man to be cheated as the petrol pump are tempered such that it displays the amount as entered by the provider but the quantity of fuel that is filled in the customer's fuel tank is much lesser than the displayed value. As analogy meter does not show exact amount, we can't cross check the fuel added and thus people are helpless despite of knowing the fraud by petrol pump owners which make them earn fortune. Fuel theft while parking is also a disturbing fact all over the world. The main objective of our project is to present a proper solution for indicating the exact availability of fuel in the tank digitally which will calibrate the exact amount of fuel contained in the vehicles tank as well as flowing into the fuel tank with the help of an ultrasonic sensor. In our endeavour to make it more digital, we will also demonstrate the measure of fuel in a vehicle when it gets stolen.*

Keywords: Fuel Level Indicator

I. INTRODUCTION

In today's fast paced world where digitalisation is at peak making thinks more interactive and easier to deal with, we have come up with the idea to developed a digital fuel indicator. A fuel indicator is an instrument used to indicate the amount of fuel present in the tank commonly used in cars and bikes. We have also included various other features like the distance that can be travelled with the corresponding fuel, Mileage, by using GPS to know the current position of vehicle, SMS alert system etc. The main objective of the project is to get the real time amount of fuel present in vehicle in both the working and ideal condition with the use of ultrasonic sensor, and the distance that can be travelled by vehicle by the use of hall effect sensor. This project helps to avoid a lot of problems like fuel bunk at fuel stations, fuel theft by means of use of SMS alert and prevents us from getting into situations where we have to push our vehicles due to assumptions of the level of fuel. As fuel prices are all time high in developing country, where people are also more obsessed with mileage, manual calculations to know the mileage of a particular vehicle is not that easy. In conventional fuel mileage calculation method, the results are obtained by two successive refuelling of the tank and also by the in-vehicle parameters. The drawback of this process is that the results obtained will be after a day or two and also it is time consuming. Thus, demand grows for capability to display fuel mileage consumption in real time which is cost effective and can be used to help to get the better efficiency of vehicle. Last but not the least the most important the GPS system which will also work as anti-theft system for the vehicle in case bike get stolen.

1.2 Problem statement

The use of analog usage of a system that is fitted to most of the vehicles today do not give an accurate information about the features such as to know the exact amount of fuel left, the petrol indication in the form of points and analog meters which lead to miscalculations to what distance vehicle can go with present fuel in tank. 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.

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1.3 Proposed Solution

This project focuses 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. Finally, once the fuel is filled at a bunk the device also sends an sms to the vehicle owner indicating the amount, quantity, and date, time etc. And also gives the exact location the vehicle.

1.4 Aim

The aim of the project is to monitor the fuel level in the tank and also gives the indication of alarm below reserve level in the tank. So we can easily know the fuel quantity level in the tank.

1.5 Objective

The objective of this project is to monitor the fuel level in the tank and also gives the indication below reserve level in the tank. So, we can easily know the fuel quantity level in the tank. In each and every field the need of automation goes on increasing.

1.6 What Is Fuel Level Indicator

A fuel level indicator is a device designed to make precise measurements of fuel level in vehicle tanks. These measurements combined with a GPS tracking and telematics platform functionality enable the following data to be harvested:

- Fuel level in the tank of a vehicle
- Fuel refilling
- Vehicle idling
- Fuel usage monitoring
- Fuel theft prevention
- Fuel refills or drains
- Fuel consumption per time period
- Average fuel consumption (miles per gallon, mpg)

1.7 Liquid Level Sensing Technologies

For a general-purpose to detect the volume/level of fluid in a particular tank, there is a wide range of available sensing technologies, including mechanical, magnetic, pressure (hydrostatic, bubbler, differential), electrostatic (capacitive, inductive), radar and ultrasonic.

- Mechanical tank sensors normally sense the position of a float, floating on the fluid, by a mechanical linkage inside/outside the tank.
- Magnetic tank sensors commonly sense the position of a float by a mechanical linkage attached from a float to a magnet. Modern magnetic sensors are based on Hall effect (A phenomenon that occurs when an electric current moving through a conductor is exposed to an external magnetic field applied at a right angle, in which an electric potential develops in the conductor at a right angle to both the direction of current and the magnetic field.).

II. Literature Review

This topic mainly based on the digital display of exact amount of fuel in container. There is lots of evolution on this project and research are ongoing for the digital display of exact amount of fuel in container. This is will also provide cross verification of sudden change in the fuel in container. Here GSM modem can also be used to get the SMS alert to the owner of Car/Bike for sudden change with message contain the difference of amount of fuel. Using Flow sensor and hall effect sensor we can also find the Milage of vehicle.

To understand how work, we have created flow chat.

[1] In this paper, the implementation of a novel algorithm for the measurement of the transit time is reported. It has been applied to implement a smart, ultrasonic sensor for the fluid level measurement on a tank by processing the detected signal. A prototype of an on-line operating device, assembled to demonstrate the performance of the algorithm, is also described. Simulation tests have been carried out to investigate the algorithm performance, and we report on the results obtained. In addition, the results obtained during the field testing and application of the developed sensor are reported.

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[2] Micro-climate monitoring usually requires deploying a large number of measurement tools. By adopting vehicular wireless sensor networks (VSN), we can use fewer tools to achieve fine-grained monitoring. This work proposes VSN architecture to realize micro-climate monitoring based on GSM short messages and availability of GPS on vehicles. We demonstrate our prototype of a GSM-based vehicle network to monitor the concentration of carbon monoxide (CO) gas in areas of interest.

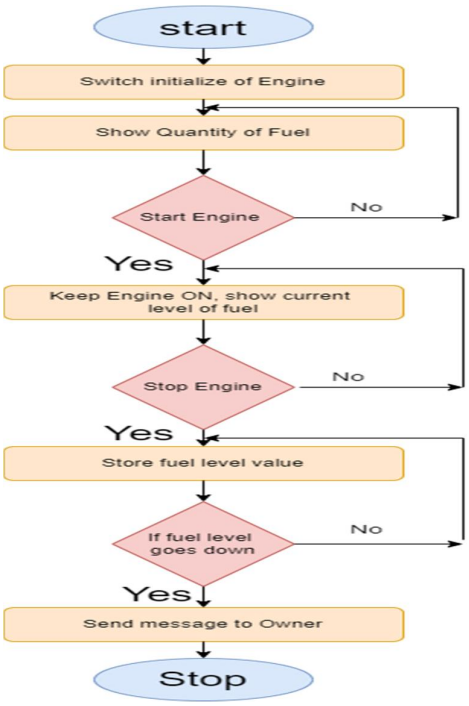

Diagram 2.1: Flow chart

This paper is displaying one of the models of the detection of CO sensor using two modems GSM and GPS. The paper showed the proposed system design, the block diagram, working principle and the simulation results. The main idea of the working principle of the system is detecting the carbon monoxide and sending a signal to microcontroller for activating GSM and GPS modems. Initially GPS modem identify the location of vehicle and then sending message to R.T.A office through SMS by using GSM modems. We are calculating the fuel level and displaying on LCD

[3] The proposed idea consists of ultrasonic technique forfuel measurement that acquires the measured fuel level and sends to the display unit which is present on the dash board. The data acquired from the sensor is given to the microcontroller. The processor processes the data by calculating the liter value that send to the display unit. At the same time voltage sensor which is connected in between the battery and arduino uno microcontroller gives we reading on display unit of the percentage of charge are left in the battery.

[4] Today's world need digital techniques for measurement of any quantity conventional fuel meter are analog so that we trying to make it digitized to show the fuel value digitally. In our project we show the amount of fuel present in fuel tank digitally i.e. 1lits, 1.5lits, 2lits etc. Also fuel theft is measure problem in all over world. In our project if fuel gets theft then text message will send to owner of bike also buzzer makes noise so that owner of bike get aware. In traditional vehicle system such kind of system not implemented like display fuel availability digitally & fuel theft of bike can be avoided.

Digital Fuel Meter used for prevention from fuel theft & also it display the available fuel in tank in digitally. This meter is more advantages over analog meter by PIC microcontroller and GSM owner of bike is aware from fuel thefting using buzzer or SMS to the owner of bike. We increase the standard of measurement system using Digital Fuel Meter because of Digital Fuel Meter cheating with customer by fuel filling station can be avoided and performance of system also improved with the help of Digital Fuel Meter.

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III. METHODOLOGY

The proposed system aims in the measurement of the fuel in the vehicle tank using ultrasonic sensor. The ultrasonic sensor has a better accuracy and it is easy to calibrate and interface it with aurdino 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.

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 spokes 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.

3.1 Block Diagram

The block diagram of the Digital fuel level indicator system includes of a Container, an ultrasonic sensor, a power supply (External supply), an Arduino (Microcontroller), an LCD (Display), and a Hall effect sensor.

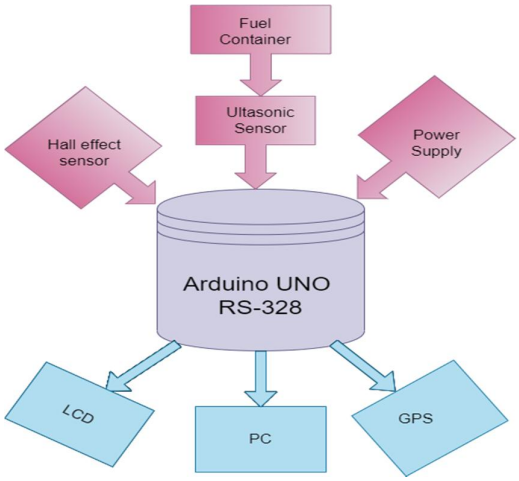

Diagram 2.2: Methodology

The Digital electronics aims in measuring the fuel in the Container using ultrasonic sensor/Level sensor. The ultrasonic sensor has highly of accuracy and it is easy to calibrate than using float level sensor and interface it with an Arduino controller which is used for our project work. The ultrasonic sensor sends ultrasonic waves and reflects it back to the receiver of the ultrasonic sensor. In this way we can find the level of fuel in the fuel tank if we know the time required by the ultrasonic waves to travel. Nowadays, we are using an Arduino because it is more reliable than the 8051 controllers. Moreover, we can also use Hall effect sensor which will take reading of wheel rotation so that we can also measure the distance covered by the vehicle to calculate Milage of Bike/Car.

In proposed system, ultrasonic sensor is connected to fuel container to find the exact level of fuel in the container in the litres. Ultrasonic sensor provides input the Arduino. Similarly, Hall effect and flow sensor also provides input to the Arduino which will calculate the milage of Car/Bike. The external power supply has been provided to the Arduino. After receiving all the input data to Arduino, Code will be run to achieve expected output as Fuel in litres, Distance using cover with fuel in the container, Milage in KM/Litres on LCD.

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IV. HARDWARE USED

4.1 Arduino Rs-328

Features of Micro-controller ATmega328:

The Arduino Uno R3 is an ATmega328P microcontroller-based development board. This is widely popular in Embedded electronics because of the available resources and easy to use by everybody features. With 14 digital input/output pins where 6 can be configured and used as PWM outputs, 6 as analog inputs is a great addition for I/O related operations. Powered with a 16 MHz ceramic resonator, an USB connection, a power jack, an ICSP header, and a reset button.

It includes a LED that can be useful in multiple applications or to test the board functionality. A voltage regulator, better to say an LDO, is available inside this development board to make this Arduino compatible for a wide range of input voltages. The application is very easy, just upload the code, and run

A. Features:

- **Model Type: UNO Rev R3**
- **Microcontroller Chip**: ATmega328P
- **Operating Voltage (VDC)**: 5
- **Input Voltage (Recommended)**: 7-12V
- **Input Voltage (limit)**: 6-20V
- **Analog I/O Pins:** 6
- **Digital I/O Pins:** 14 (of which 6 provide PWM output)
- **PWM Digital I/O Pins**: 6
- **DC Current per I/O Pin (mA):** 40
- **DC Current for 3.3V Pin (mA):** 50
- **Clock Speed:** 16 MHz
- **SRAM (KB):** 2
- **EEPROM:** 1 KB (ATmega328)
- **Flash Memory:** 32 KB
- **On Board LEDs:** On/Off, L (PIN 13), TX, RX
- **Dimensions in mm (LxWxH):** 75 x 54 x 12

Figure 4.1: Arduino

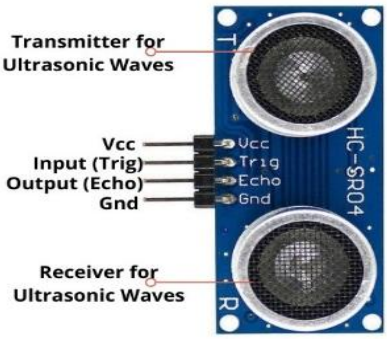

Figure 4.2: **Ultrasonic sensor**

4.2 Ultrasonic Sensors

Ultrasonic Sensor can generate and sense the Ultrasonic energy. It broadly works in 3 phases - transmitters, receivers and transceivers. Echo is basic of principle of working of Ultrasonic sensor. The Ultrasonic waves are transmitted to an object and the reflected waves are received by the sensors.

Ultrasonic sensor is easy to install. Generally, any opening above the tank, such as vent pipe can accommodate these sensors. This means the tank need not to be modified, by drilling holes just for a sensor installation. Also, they need not to be in contact with the fuel during measurement of fuel level. That means it can work effectively even in corrosive environments.

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HC-SR04 Ultrasonic Distance Sensor Module from Easy Electronics is a device that can measure the distance of an object by using ultrasound waves. For this, it sends out a sound wave at a specific frequency and listens to the sound wave to bounce back. Simply by recording the lapse time it becomes easy to calculate the distance between the sonar sensor and the object.

4.2.1 Important Features of Ultra-Sonic Sensors

- Voltage capacity: 5V
- Output signal: 5V high and 0V low
- Sensor angle not more than 15 degrees
- Sensor bounces back: 2cm to 450cm

4.2.2 Operating Principle of the Ultrasonic Sensor

The Ultrasonic Distance Sensor from Easy Electronics measures distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic sensors measure the distance to the target by measuring the time lapse between the emission and reception.

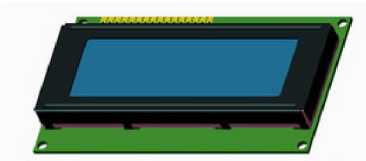

Figure 4.3: LCD

Figure 4.6: Hall effect sensor

Figure 4.8: Flow sensor

4.3 LCD Display

It features 20x4 means that 20 characters can be displayed in each of the 4 rows of the 20x4 LCD, thus a total of 80 characters can be displayed at any instance of time. It features 5X8 dots with cursor. It has a built-in controller. It operates on +5V power supply. It possesses 1/16 duty cycle.

4.4 Hall Effect Sensor

Hall effect sensors is consisting of a thin piece of p-type semiconductor material that passes a continuous electric current through itself. When the hall effect sensor is placed within a magnetic field, which is constructed at right angle to the device, the magnetic flux lines exert a force on the semiconductor material. Generally, a south pole is used to generate a potential difference across the device and the effect of generating measurable voltage by using magnetic field is called Hall effect. The Arduino Hall effect sensor code can be used to detect a magnet and counts the number of times it detects it.

4.4.1 Features & Details of Hall Effect Sensor

- Product name: hall effect sensor; model: 44E
- Pin number: 3; pin Length: 16mm/ 0. 63 inches
- Net weight: 2G; package content: 10 x hall effect sensor
- Size: 19 x 4 x 1. 5mm/ 0. 75" x 0. 16" x 0. 06" (l*w*t); material: electric part
- Supply Voltage: 4. 5-28V; output current: 25mA

4.5 Flow Sensor

A flow sensor is an electronic device that measures or regulates the flow rate of liquids and gases with pipes and tubes. They are generally connected to gauges to render their measurements but can also be connected to computers and digital

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interfaces. Flow sensors are able to detect leaks, blockages, pipe bursts and any changes in liquid concentration due to contamination or pollution. Flow sensor can detect the amount of fuel flow having 0.3 to 6 litre per minute flow rate.

4.6 Power Supply

The Arduino board can operate on an external voltage supply of 6 to 20 volts. If it supplied with voltage less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If used more than 12V supply, the voltage regulator may overheat and it may damage the Arduino board. The recommended range is between 7 to 12 volts.

Figure 4.7: Battery

V. Advantage, Disadvantage and Application Of Digital Fuel Level Indicator System

5.1 Advantages

- Low power consumption.
- It is used to monitor the fuel level in the tank.
- Simple and efficient.
- Less expensive.
- Accuracy is high.

5.2 Disadvantages

- Cost is relatively high than analog meters.
- High maintenance required.
- It is robust in construction.
- Accuracy may vary while driving through hill stations.

5.3 Application

- The fuel level monitoring system can be used in many industries Applications such as water tank, chemical tanks etc.
- In chemical Tanks lot of risk is involved to employ man power for checking the liquid level of the tank.
- This project is used to monitor the fuel level in the tank.

VI. Future Directions

- Our technology can be further enhanced in the future.
- In case of theft of vehicle, it can stop i.e the engine can be shut down remotely using additional software enhancements.
- Speed of the vehicle can be limited.
- Location of the vehicle can be determined at any point of time.

VII. Conclusion

Gives accurate value of remaining fuel in container due to this we can predict distance Vehicle can cover with available fuel. Operation time taken by the system is very less (in Micro second). All the Hardware used have long life as well as Quality material. This system is able to display with simple hardware we can design more accurate fuel level monitoring

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system. Cost of this project is reasonable also able to implement in all the Car/Bike. This is project is not only limited to calculate fuel in the tank but also this system can be used to find the level of underground water or other fluid which are harder to measure. Digital fuel level indicator system is Digital Fuel level Indicator system is advance type of fuel measurement. This system best and will highly use by automobile system as Fuel price is increasing drastically.

This project is able to show that with simple available hardware and technology we can construct a robust fuel level monitoring system. The system designed and tested in this project is presented at the low construction cost. Even though the quality of material used and components used are of good quality, the cost of the project is not reasonable and it can be used and implemented in all vehicles without much increase of cost of the vehicle.

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