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Automatic Monitoring of Fuel in Vehicles Using ATMEGA328 Microcontroller

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ABSTRACT: Monitoring of fuel going inside the tank during fuel filling process is a difficult task. With the help of this system fuel going inside the tank when the fuel is being filled can be monitored. This type of system can be used to measure the amount of petrol, diesel or some other type of liquid. The purpose of this device is to prevent fraud in petrol pumps where in some cases the quantity of fuel displayed in the filling machine is not the actual quantity of fuel going inside the tank. This situation occurs in few petrol pumps as the filling machine is tampered by the owner or the employee of the pumps and the customers get cheated. Hence, this device when installed in the tank of a vehicle prevents the customer from getting cheated.

KEYWORDS: Fuel, Monitoring, Frauds, Tampered.

I.INTRODUCTION

Presently most of the motor vehicles display the amount of fuel in the fuel tank with the help of some or the other kind of indication showing the E (empty), H (half) and F(full) indicators. The manufacturer provides the specification that E, H and F bar maps corresponding to the litres of fuel approximately. In daily life we might have experienced the problem of improper measurements of the fuel level in the tank with the existing system. Today in this digitized worldif theanalog fuel indicators in the vehiclesare replaced by digital system then it will help us to know the exact amount of fuel present in the tank**.**

Currently the fuel indicator system for the most of the vehicles areanalog andthey do not show the exact amount of fuel present in the tank. So this problem is taken into consideration in this work for developing the digital fuel indicator system for two wheelers which shows exact amount of fuel in terms of millilitre.

A fuel level monitoring system is a device which can be mounted in the fuel tank of a vehicle. It can be mounted in any tank and the fuel going inside the tank is monitored with the help of an ultrasonic range finder this is triggered from the ATMEGA328 microcontroller. The ultrasonic range finder can sense any type of liquid such as water, gasoline, diesel, kerosene, etc. The ultrasonic range finder used in this project can measure distances from 2cm to 400cm with an accuracy of 3mm. Hence, it displays accurate volume of fuel. A 20*4 LCD display is interfaced with the ATMEGA 328 micro controller. Therefore, it displays the volume of fuel digitally.

II.SYSTEM DESCRIPTION

Fig.1 shows the block diagram of digital fuel monitoring system using ATMEGA328 microcontroller. The ultrasonic range finder is mounted on the surface of the fuel tank .The ultrasonic range finder is programmed to send 8 pulses for a period of 10 microseconds. The time taken to receive these pulses is determined by the ultrasonic range finder. The distance of the fuel level from the ultrasonic range finder is calculated by using the relation Distance = speed*time. The volume of fuel is calibrated from the distance of the fuel obtained from the ultrasonic range finder.

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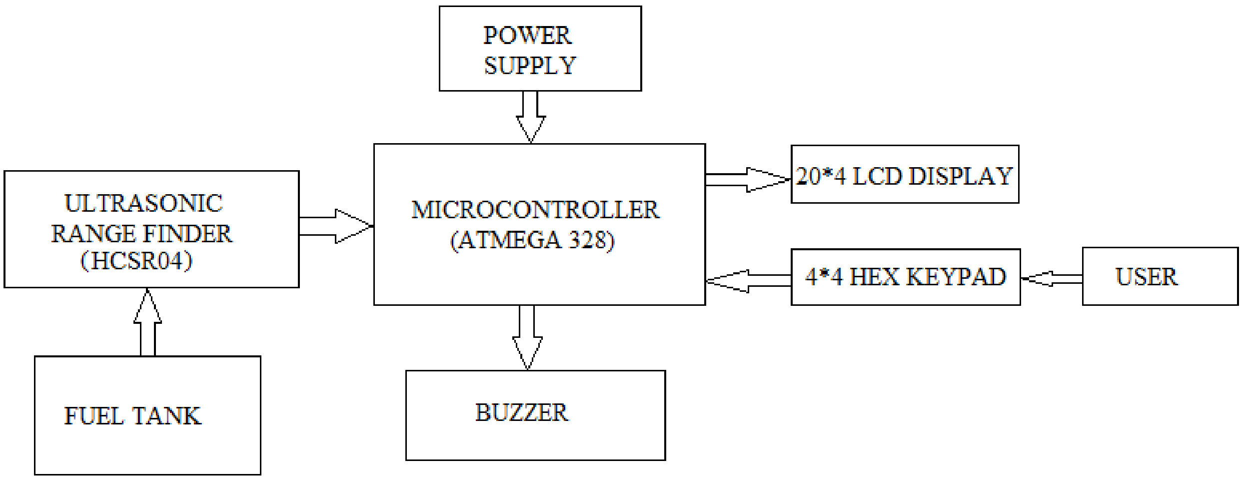

Fig.1: Block diagram of an Digital Fuel Monitoring System

The LCD display is interfaced with the microcontroller in such a way that when the microcontroller is switched on the current value of fuel is displayed. The microcontroller then checks for the quantity of fuel in the tank and accordingly asks the user to enter the quantity of fuel to be filled. The user can then enter the quantity of fuel to be filled through the keypad which is also interfaced to the microcontroller. After the user gives input time delay is given for the filling of fuel in the tank. After the tank is filled the microcontroller checks for the quantity of fuel and if the volume of fuel is not filled properly as specified then the microcontroller is programmed in such a way that the remaining amount of fuel to be filled is displayed in the LCD. The process ends when the volume of fuel filled is as per specifications of the user.

III.HARDWARE SPECIFICATIONS

The hardware used in implementing this project are:

3.1: ATMEGA328 Microcontroller

The ATmega328 is a single chip micro-controller created by Atmel and belongs to the mega AVR series. The pin diagram of ATMEGA328 is as follows:

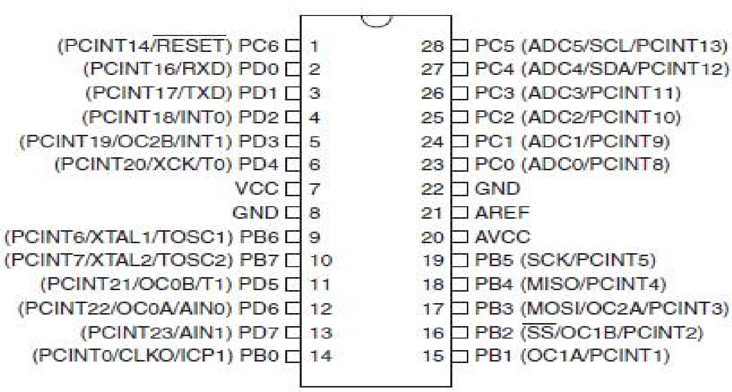

Fig.2: Pin diagram of ATMEGA328

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose Input/Output lines, 32 general purpose working

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registers andthree flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented two wire serial interface, SPI serial port, 6-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS per Mhz.
Today the ATmega328 is commonly used in many projects and autonomous systems where a simple, low-powered, low-cost micro-controller is needed. Perhaps the most common implementation of this chip is on the popular Arduino development platform, namely the Arduino Uno and Arduino Nano models.

3.2: HC-SR04 Ultrasonic Range Finder

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of working is:

Fig.3: HCSR04 Ultrasonic Range Finder

(1) Using IO trigger for at least 10us high level signal,
(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
(3) If the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
Test distance = (high level time×velocity of sound (340M/S) / 2.
The ultrasonic range finder consists of MAX3232 IC which converts an electrical signal to ultrasonic pulse. It also consists of LM358 op-amp which is used in amplifying the electrical signal obtained from the received ultrasonic pulse.

3.3: 20*4 Liquid Crystal Display:

20*4 LCD allows us to display 20 characters in a line for four rows. It is a parallel enabled LCD. It consists of 16 pins of which eight pins are data lines. The other eight pins include VDD, VSS, RS, E,R/W, A, K, V0.
In this project we use only four data lines because using all the eight data lines would consume more pins in the microcontroller. VDD and VSS are the power supply pins to the LCD, V0 is connected to a 10k potentiometer in order to adjust the brightness. R/W pin is grounded as we are using the LCD only for writing and not reading. A and K pins are the power supply for backlight. RS and E pins are connected to the microcontroller.The Liquid Crystal Library allows you to control LCD displays that are compatible with the Hit-achi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface.

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Fig.4: 20*4 LCD

3.4:4*4 Hex Keypad:

The Hex Keypad has 16 buttons in a 4 by 4 grid, labelled with the hexadecimal digits 0 to F. Internally, the structure of the hex keypad is very simple. Wires run in vertical columns (we call them C0 to C3) and in horizontal rows (called R0 to R3). These 8 wires are available externally, and will be connected to the lower 8 bits of the port. Each key on the keypad is essentially a switch that connects a row wire to a column wire. When a key is pressed, it makes an electrical connection between the row and column.

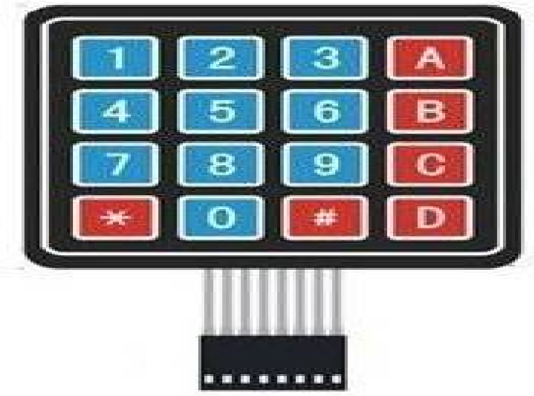

Fig.5:4*4 Keypad

.IV.CALIBRATION DETAILS

The variation of the distance measured with respect to the volume of fuel has been calibrated for a 1.2 litre tank of 13 cm height and a diameter of 12cm is shown in the table below:

VOLUME (ml)	DISTANCE (cm)
0	17
100	16
200	15
300	14
400	13
500	12

Table1: Calibration chart up to 500ml

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The figure above gives the calibration details for the volume of fuel up to 500ml. We can see that for the tank we have considered the distance varies from 17cm to 12 cm for the volumes from 0ml to 500ml. Similarly the calibration details from 600ml to 1200ml is shown in the table below and we see that the distance varies from 11cm to 5cm.

VOLUME (ml)	DISTANCE (cm)
600	11
700	10
800	9
900	8
1000	7
1100	6
1200	5

Table2: Calibration chart from 600ml to 1200ml

V.EXPERIMENTAL SETUP

The figure below shows the Prototype of Automatic Monitoring of Fuel in Vehicles using ATMEGA 328 Microcontroller for a 1.2litre fuel tank of height 13cm and 12cm diameter with water as the test fuel.

Fig.6: Prototype of Digital Fuel Monitoring System using ATMEGA328

VI.MERITS AND DEMERITS

Merits:

- The accurate volume measured helps in preventing frauds in petrol pumps.
- It serves as a fuel gauge for the user to take precaution during travel.
- It can measure any type of liquid.
- This device has high accuracy.
- Displays the volume of fuel digitally.
- It is relatively very cheap as compared to the present technologies.

Demerits:

- The accuracy is affected when vehicle is in motion.
- Complex to implement when the dimension of the tank is changed.

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VII. CONCLUSION

The measurements are taken so the accuracy level is of 95% - 98%. Thus it is an efficient device made by keeping in mind the petroleum thefts at the variouspetrol pumps at the time of filling of tanks.The existing traditional and the microcontroller based float type measurement techniques are far from exact and are on the conservative. A more efficient and reliable sensing technology is the ultrasonic range sensing system with a microcontroller which has corrective action code inbuilt that is applied to the fuel sensor signal based on measurements to provide highly accurate measurement of the level of fuel in the tank.

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