Design and Development of Digital Fuel Gauge Along With Alcohol and Collision Detection

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Abstract—Petrol bunk frauds are increasing day by day. Most of the petrol bunk 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. Most of the vehicles in India consist of analog meters hence it is not possible to accurately know the amount of fuel in the fuel tank and also it is not possible to cross check the quantity of fuel filled at the petrol bunk. This project aims at creating a digital display of the exact amount of fuel contained in the fuel tank of the vehicle and also helps in cross checking the quantity of fuel filled at the petrol bunk. Finally once the fuel is filled at the petrol bunk the device sends an SMS to the vehicle owner indicating the amount and quantity. This project is designed to reduce the accidents caused on the roads due to the consumption of alcohol by the driver. The device senses the alcohol molecules present in a specific range and if found, fails the attempt of the driver to start the vehicle. In today’s world there is a severe increase in the use of vehicles. This takes a toll on the property as well as human life loss because of unavailability of immediate efforts to provide the emergency facilities to the victims in the shortest time possible. This project aims at solving this problem by sending the message to pre-loaded number immediately after recognizing the collision using GPS.

Index Terms— Alcohol sensor, ATmega32 Microcontroller, Collision sensor, GPS Module, GSM Module, LCD Display, Pressure Sensor.

I. INTRODUCTION

In this modern and fast running world everything is going to be digitized and easily understandable and also to give exact calculation. The digital fuel gauge is used. It shows the exact amount of fuel remaining in the tank as compared to previously used analog meter in which a needle moves to give a rough estimation of fuel remaining in the tank commonly used in cars, bikes these may also be used in tank including underground storage tanks.

As used in cars fuel gauge as two parts:-

- Sender unit
- Indicator unit

The sending unit usually uses a float connected to a variable resistor. When the tank is fuel, the resistor is set to its low resistance value. As the tank empties, the float drops and slides a moving contact along the resistor, increasing its resistance, finally reaching its highest value when the tank is empty. In addition, when the resistance is at a certain point, it will also turn on a “low fuel” light on some vehicles.

Meanwhile the indicator (usually mounted on instrument panel) is measuring and displaying the amount of electrical current is flowing through the sending unit. When the tank level is height and maximum current is flowing, the needle point to “F” indicating the full tank. When the tank is empty and least current is flowing, the needle points to “E” indicating an empty tank.

According to Times of India survey 34% of the accidents takes place on the road because of the reckless driving of the driver after consumption of alcohol. Considering the substandard condition of Indian roads and accidents due to alcohol consumption, a system needs to be designed which fails the attempt of the driver to start the vehicle.

Lot of accidents happens on highways due to increase in traffic and rash driving. In many situations the family or the ambulance and the police authority is not informed in time. This result in delay of the help extended to the person who has met with an accident. The GPS and GSM modules are incorporated in the system to send the message to the pre-loaded number.

II. PROBLEM STATEMENT

Analog fuel meter indicates three states of fuel level which are empty, half and full. So it is difficult to know the exact amount of fuel present in fuel tank. Analog fuel meter shows the amount of fuel by using needle. But due to this it is difficult to get proper idea about exact amount of fuel level present in fuel tank.

Most of the accidents occurred on roads are due to the consumption of alcohol by the driver. In most of the cases when accidents occur victims are denied of emergency facilities.
III. LITERATURE SURVEY

Most of the vehicles around the world consist of analog fuel meter. This meter indicates three states of fuel level which are empty, half and full. So we cannot judge the actual fuel present in the fuel tank. Analog meter shows the fuel level by using needle. But due to this we do not get proper idea about fuel level present in fuel tank. Due to improper knowledge of fuel present in the tank we can undergo in trouble due to low fuel. Considering previous analog system advanced system is implemented which consists of digital fuel meter and theft detection. In digital fuel meter the amount of fuel in the tank is indicated in liters. This value in liters will be in numerical digits (Ex: 1 lit, 1.5 lit, 2 lit) [1].

India had earned the dubious distinction of having more number of fatalities due to road accidents in the world. Road safety is emerging as a major social concern around the world especially in India. Drinking and driving is already a serious public health problem, which is likely to emerge as one of the most significant problems in the near future. The system implemented by us aims at reducing the road accidents in the near future due to drunken driving. The system detects the presence of alcohol in the vehicle and immediately locks the engine of the vehicle. Hence the system reduces the quantum of road accidents and fatalities due to drunk driving in future [5].

Prevention of accidents remains on one side as a huge question mark but rather on the other we look up for something as a life saving measures to safeguard our self in case of occurrence of any accidents. Many lives would have been saved if the emergency service could get the crash information in time. In order to solve the problem of death caused by accident which occur because of the delay in help provided by rescue, can be solved by a new system of accident detection technique which finds out the occurrence of accident through various sensors and intimate the occurrence of accident to the nearest rescue teams or patrol services by the use of GSM and GPS system [10].

IV. PROPOSED WORK

The block diagram mentioned above consists of microcontroller ATmega32, pressure sensor, 16x2 LCD display, GPS Module, GSM Module, alcohol sensor, SPDT Switch. The microcontroller is initialized and the fuel level in the tank is measured and LCD displays the fuel amount in the tank. If any fuel is added in the tank then pressure will increase and this pressure is measured by the pressure sensor and it sends analog signals to the microcontroller. The microcontroller has inbuilt ADC which converts analog signal into digital value and it is displayed on the LCD. Then microcontroller enables the GPS modem receive and the coordinates of latitude and longitude and send the location information to predefined number using GSM modem. The alcohol sensor senses the presence of alcohol molecules in the surrounding and if present it sends an indication to the microcontroller. The microcontroller stops the motor if alcohol presence is indicated. The collision sensor, SPDT switch used here sends a SMS to a pre-loaded number using GPS and GSM modules if collision occurs.

![Block diagram of digital fuel gauge](image)

Figure1: Block diagram of digital fuel gauge

V. COMPONENTS

The main components required for the functioning of the above proposed solution are elucidated below.

A. Microcontroller

The ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC
architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the System designed to optimize power consumption versus processing speed. ATmega32 has got 40 pins. Two for Power (pin no.10: +5v, pin no. 11: ground), Two for oscillator (pin 12, 13), one for reset (pin 9), three for providing necessary power and reference voltage to its internal ADC, and 32 (4×8) I/O pins.

Figure2: AtMega32 microcontroller

B. Pressure sensor

The MPX2010 series silicon piezo-resistive pressure sensors provide a very accurate and linear voltage output directly proportional to the applied pressure. These sensors house a single monolithic silicon die with the strain gauge and thin film resistor network integrated. The sensor is laser trimmed for precise span, offset calibration and temperature compensation. Piezo-resistance is defined as a change in electrical resistance of solids when subjected to stress fields. Piezo-resistors have high gain and exhibit a good linear-relationship between the applied stress and the resistance change output. But these sensors suffer on account of temperature dependence of the piezo-resistive coefficients. This piezoresistive nature of silicon makes the use of diffused or implanted resistors an obvious and straightforward technique for measuring the strain in a micro machined silicon diaphragm. These piezo-resistors convert the stresses induced in the silicon diaphragm by the applied pressure into a change of electrical resistance, which is then converted into voltage output by a Wheatstone bridge circuit.

Figure3: MPX10kpa Pressure sensor

C. Alcohol sensor

The MQ-135 gas sensor senses the gases like ammonia nitrogen, oxygen, alcohols, aromatic compounds, sulphide and smoke. The boost converter of the chip MQ-3 gas sensor is PT1301. The operating voltage of this gas sensor is from 2.5V to 5.0V. The MQ-3 gas sensor has a lower conductivity to clean the air as a gas sensing material. In the atmosphere we can find polluting gases, but the conductivity of gas sensor increases as the concentration of polluting gas increases. MQ-135 gas sensor can be implementation to detect the smoke, benzene, steam and other harmful gases. It has potential to detect different harmful gases. The MQ-135 gas sensor is low cost to purchase.

Figure4: Alcohol sensor

D. GSM SIM 800

SIM800 is a complete Quad-band GSM/GPRS solution in a SMT type which can be embedded in the customer applications. SIM800 support Quad-band 850/900/1800/1900MHz, it can transmit voice, SMS and data information with low pressure consumption. With low power consumption. With tiny size of 24*24*3mm, it can fit into slim and compact demands of customer design. Featuring Bluetooth and embedded at, it allows total cost savings and fast time-to-market for customer applications.

Figure5: SIM800

E. GPS MODULE

The SkyNav SKM53 Series with embedded GPS antenna enables high performance navigation in the most stringent applications and solid fix even in harsh GPS visibility environments. It is based on the high performance features of the Media Tek 3329 single-
chip architecture, its –165dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GPS was not possible before. The 6-pin UART connector design is the easiest and convenient solution to be embedded in a portable device and receiver like PND, GPS mouse, car holder, personal locator, speed camera detector and vehicle locator.

Figure 6: SkyNav

F. LCD

We are using a high quality 16 characters by 2 line display module, with back lighting.
1. 16 Characters x 2 Lines
2. HD44780 Equivalent LCD Controller/driver Built-In
3. 4-bit or 8-bit MPU Interface
4. Standard Type
5. Works with almost any Microcontroller.

Figure 7: LCD

G. Collision sensor

A Single Pole Double Throw toggle switch connects a common terminal to one or the other of two terminals. It is always connected to one or the other. The two outside terminals are never connected to the switch. A Single Pole Double Throw (SPDT) switch is a switch that only has a single input and can connect to and switch between 2 outputs. This means it has one input terminal and two output terminal.

A Single Pole Double Throw switch can serve a variety of functions in a circuit. It can serve as an on-off switch, depending on how the circuit is wired. Or it can serve to connect circuits to any 2 various paths that a circuit may need to function in.

Figure 8: SPDT Switch

H. RELAY

DPDT Relay can be used to power wither one device/appliance or another. While SPDT relay can only switch the output circuit between on and off states; a DPDT relay can also be used to change the polarity at the terminals of a device connected at output.

Figure 9: DPDT Relay

I. DC Motor

A DC MOTOR in simple words is a device that converts electrical energy (direct current system) into mechanical energy. Basic construction of DC motor contains a current carrying armature which is connected to the supply end through commutator segments and brushes. The armature is placed in between north south poles of a permanent or an electromagnet as shown in the diagram above.

As soon as we supply direct current in the armature, a mechanical force acts on it due to electromagnetic effect of the magnet. Now to go into the details of the operating principle of DC motor it’s important that we have a clear understanding of Fleming’s left hand rule to determine the direction of force acting on the armature conductors of DC motor.

Figure 10: DC Motor
VI. RESULTS

![Figure 11: Prototype of Digital fuel Gauge](image1)

![Figure 12: Digital display of amount of Fuel filled](image2)

![Figure 13: Location Identification](image3)

![Figure 14: Message Received Indicating the quantity and amount of fuel](image4)

![Figure 15: Alcohol Detection Indication](image5)

![Figure 16: Collision Detection](image6)
This project presents a prototype of Digital Fuel Gauge. The main component is the pressure sensor which generates the signal based on the amount of liquid available in the tank and displays it digitally on the LCD. This prototype also includes alcohol and collision detection which ensures the safety of the driver. In the future, different vehicle company manufacturers will implement this kind of digital fuel gauge system which also provides security for the vehicle owners. Not only will the measurement be more accurate, but the hard earned money of the consumers also will not be cheated.

VIII. FUTURE SCOPE

Our project can be further enhanced in the future.
1. In case of theft of vehicle, it can be stopped i.e. the engine can be shut down remotely using additional software enhancements.
2. Speed of the vehicle can be limited.
3. Location of the vehicle can be determined at any point of time.
4. The proposed method can be improved by providing fuel cells at different places of fuel tank to measure more precise fuel levels at different conditions.
5. Alcohol detection can be implemented in heavy vehicles, air bus, navigating vehicles, sense detection machines. These are also extended to bio medical fields, software development industries.
6. Fuel leakage can be detected by implementing a fuel leakage sensor.

IX. REFERENCES