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Embedded System Based Digital Fuel Gauge for Automobiles

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ABSTRACT: *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. let 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. To 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 to find the exact location of the vehicle.*

Index Terms *—DC power supply, PIC Microcontroller, Fuel sensor, Speedometer, Temperature Sensor, Keypad, GPS, GSM, LCD Display*

1. INTRODUCTION

In this modern and fast running world everything is going to be digitized and easily understandable and also to give exact calculation. Considering this idea we started a project named Digital fuel gauge, which shows the exact amount of fuel remaining in the fuel gauge as compared to the previously used gauge meter in which a needle moves to give a rough estimate of the fuel left. A fuel indicator is an instrument used to indicate the level of the fuel contained in the tank. Commonly used in cars and bikes, these may also be used in any tank including underground storage tanks. As used in cars, the fuel gauge has two parts:-

- The sender unit
- The indicator

The sending unit usually uses a float connected to a variable resistor. When the tank is full, the resistor is set to its low resistance value. As the tank empties, the float drops and the 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 unit (usually mounted on the instrument panel) is measuring and displaying the amount of electrical current flowing through the sending unit. When the tank level is high and maximum current is flowing, the needle points to "F" indicating a full tank. When the tank is empty and the least current is flowing, the needle points to "E" indicating an empty tank.

1.1 Existing System

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. Most of the petrol bunks today have manipulated

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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. Let the pumps are tampered for the benefit of the petrol bunks owner. 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. Let the pumps are tampered for the benefit of the petrol bunks owner.

1.2 Proposed Systems

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 so that the customers cannot be cheated as they cross check the quantity of the fuel. And subsequent additional features are added to the system to assist the drivers which enhance the compatibility of the system. A fuel quantity measuring unit is designed so that exact amount of fuel is known to the driver. 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 quantity, total amount,cost per kilometer, location, and date, time etc..,

2. System Block Diagram

Initially the microcontroller is initialized and the fuel level in the tank is measured, if the fuel level is low then it is indicated on the display and fuel is filled into the tank and if the fuel is full then the pressure is sensed and the analog value is converted into digital form and keypad using fuel cost enter by the microcontroller and displayed in numeric digital form on the LCD display.

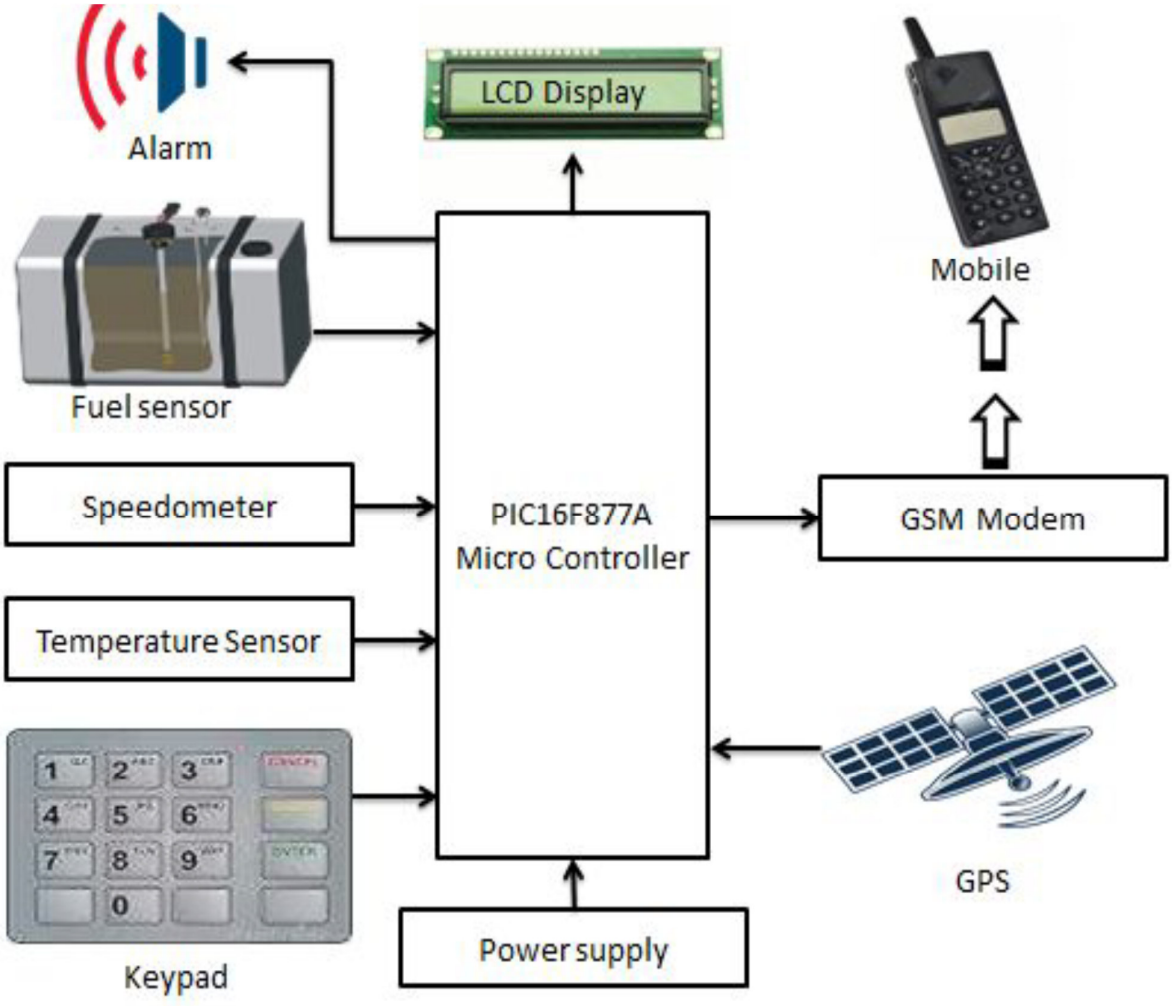

Figure 1.1 block diagram

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After digitally displaying the fuel level in the tank, total cost, with the help of GPS and GSM modem the location of fuel filling place is sent to the owner's cell phone to avoid any fraud.

2.1 Components

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

2.1 PIC16F877A Microcontroller

The Microcontroller used here is the PIC16F877. PIC (Peripheral Interface Controller) is a family of microcontrollers. It has attractive features and they are suitable for a wide range of application. It consists of I/O parts, 3 timers, ROM, RAM, Flash memory and inbuilt ADC. PIC channel 10bit inbuilt ADC which convert the analog value into 10 bit digital data. PIC is programmed to convert 10 bit data into an 8 bit data and to transmit the data into a transistor driver. Figure 2 shows the architecture of PIC microcontroller.

Features of PIC16F877A

- Word instructions to learn.
- All single cycle instructions except for program Branches which are two cycle.
- Operating speed: 20MHz clock input, 200 ns instruction cycle. High performance RISC CPU
- Only 35 single
- Up to 8k x 14 words of FLASH program memory, up to 368 x 8 bytes of Data memory (RAM). Wide operating voltage range:2.0V to 5.5V
- Low-power consumption:
- -0.6 mA typical @ 3V,4MHz
- -<1µA typical standby current
- Timer0: 8-bit timer/counter with 8-bit prescaler.
- Timer1: 16-bit timer/counter with prescaler, can be incremented during SLEEP mode.
- Timer2: 8-bit period register, prescaler and postscaler
- Timer0: 8-bit timer/counter with 8-bit prescaler.
- Timer1: 16-bit timer/counter with prescaler can be incremented during SLEEP mode.
- Timer2: 8-bit period register, prescaler and postscaler

2.2 Fuel Level Sensor

The GSlevel-1612 liquid level sensor features an SAE 5-bolt flange mount with fully-integrated electronics. The sensor is manufactured to your custom length requirement and offers a fully configurable 0-5V analogue output (typically calibrated 0.25V empty, 4.75V full).

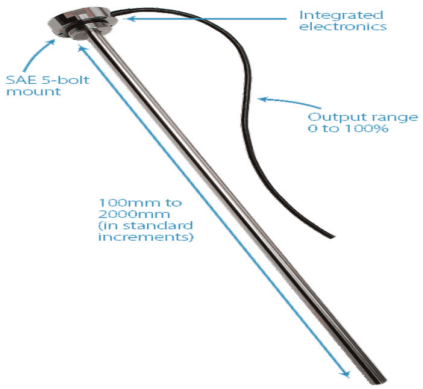

Figure 2.1 Fuel level sensors

Manufactured from aluminium, the sensor utilises capacitive technology with no moving parts to accurately detect levels of fuel. The fuel level sensor using to monitoring the fuel level of vehicle.

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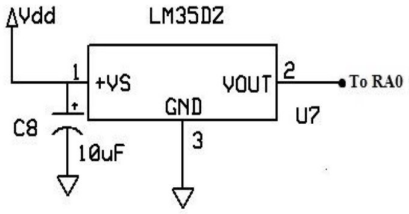
2.2 Temperature Sensor

The LM35 series are precision integrated circuit temperature sensors, with an output voltage linearly proportional to the Centigrade temperature. Thus the LM35 has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.



Low cost is assured by trimming and calibration at the wafer level. The low output impedance, linear output, and precise inherent calibration of the LM35 make interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. The sensor detects vehicle body temperature. To over temperature alarm circuit ON

2.3 Speedometer

Speedometer or a speed meter is a gauge that measures the instantaneous speed of a vehicle**.**Speed sensors for control and measurement systems this sensor provides speed and direction information. Between sensor face and a target, a target induced magnetic field is detected by rotational speed sensors. The operating temperature of the sensors is about 200oC. The temperature performance of the inductive (ISS) sensor is about 200oC. The output voltage of the sensor is proportional to the target speed and air gap. Measures the instantaneous speed of a vehicle.

2.4 Keypad

Keypad is a set of buttons arranged in a block In a key pad it has a one or more than one keys are placed in a PCB. And all the keys are commonly grounded. This is the main difference to compared to matrix keypad. These key pads having maximum 8 numbers of keys. More than 8 keys are cannot be connected because it's not an efficient one. If we need more than 8 keys means, then only we can operate it a matrix keypad. To used fuel amount enter the keypad

2.4 GPS

The Global Positioning System (GPS) is a satellite-based navigation system consists of a network of 24 satellites located into orbit. The system provides essential information to military, civil and commercial users around the world and which is freely accessible to anyone with a GPS receiver. GPS works in any weather circumstances at anywhere in the world to provides location and time information to controller.

2.5 GSM

GSM (Global System for Mobile Communications) originally from Group Special Mobile modem is a wireless modem that works with a GSM wireless network. is world's most famous Mobile platform. To use SMS to the vehicle owner indicating the amount, quantity, and date, time, location, etc..,

2.6 LCD

A 16x2 LCD Means It Can Display 16 Characters Per Line And There Are 2 Such Lines. In This LCD Each Character is displayed In 5x7 Pixel matrixes. This LCD has Two Registers, Namely, Command and Data. To indicating the quantity, total amount, cost per kilometer, location, and date, time etc..,

3. Circuit Diagram

The main blocks are micro controller unit, fuel level sensor and LCD display unit. The fuel level detection circuit is used to detect the level of the fuel in the tank. Here sensors are laced at certain place to find out the fuel level and the signal is sent to the micro controller unit for further operations. Temperature sensor detects vehicle body temperature to overheat alarm circuit ON. Fuel

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sensor is placed at fuel tank to sense the fuel level and the signal from that sensor is sent to the micro controller unit to decide the exact level information.

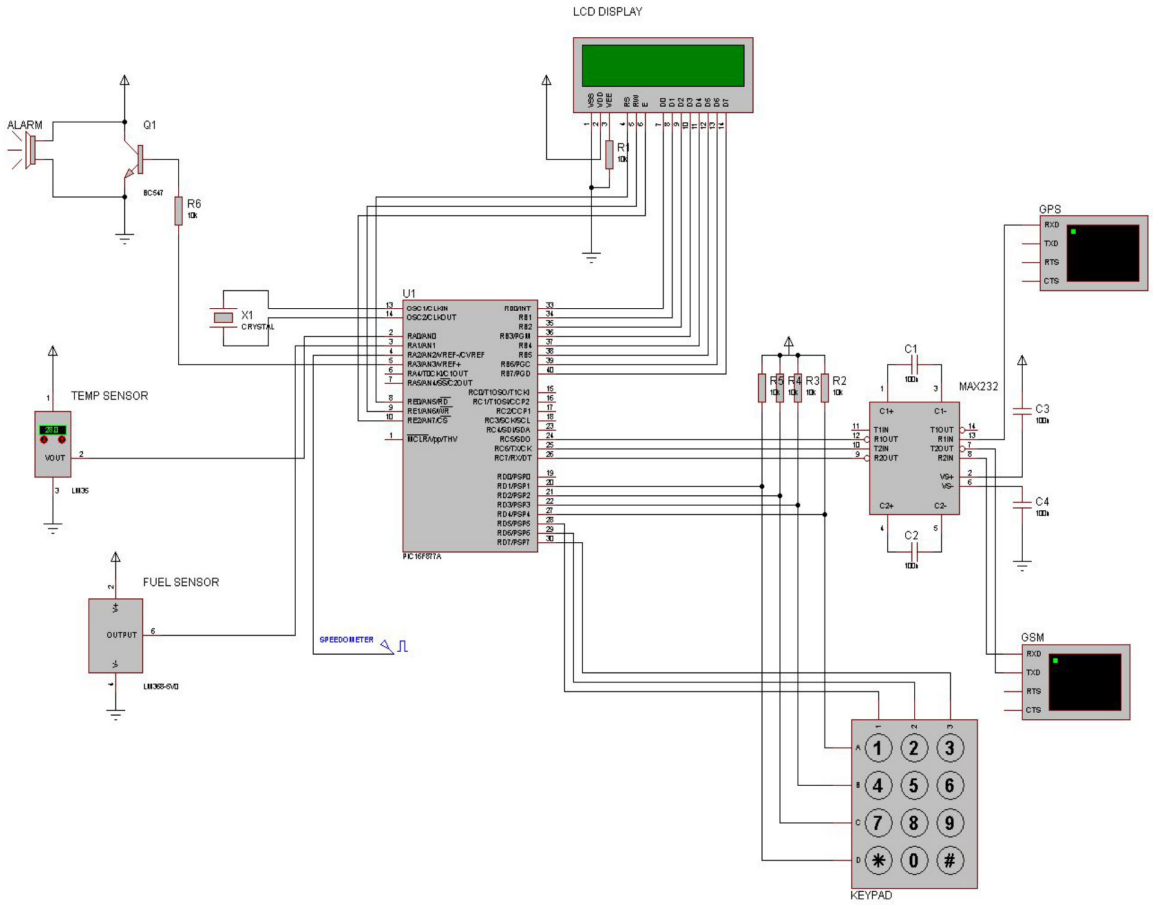

Figure 3.1 Circuit diagram

The main blocks are micro controller unit, fuel level sensor and LCD display unit. The fuel level detection circuit is used to detect the level of the fuel in the tank; here sensors are placed at certain place to find out the fuel level and the signal is sent to the micro controller unit for further operations. Temperature sensor detects vehicle body temperature to overheat alarm circuit ON. fuel sensor is placed at fuel tank to sense the fuel level and the signal from that sensor is sent to the micro controller unit to decide the exact level information. When the fuel level reaches the top level sensor which means that the tank is full and this will be indicated to the user by means of maximum tank level and the level information is indicated through LCD. With the help of GPS and GSM modem the location of fuel filling place is sent to the owner's cell phone to avoid any fraud.

Software Description

4.1. Embedded C

The embedded system market is growing rapidly and hence there is an increasing demand to write application programs in a high-level language such as C. The reasons behind this are, embedded system programming is more complex (and hence are difficult to maintain in assembly language), processors are needed to more frequent re-adaption of applications to new instruction sets and hence the lifespan of the processor model is decreased. To address these issues, the code re-usability is needed which is achieved with the help of C-level programming. As the C language has matured over the years, various extensions for accessing basic I/O hardware (iohw) registers have been added to address deficiencies in the language. Today almost all C compilers for embedded systems support some method of direct access to iohw registers from the C source level. Specific embedded-systems deficiencies in C have been addressed to reduce application dependence on assembly code. The Embedded c specification brings back the roots of C to embedded systems as primarily a high-level language means of accessing the processor. The main advantage of embedded C is it supports in-line assembly.

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Results and Discussions

Since in today's real world the fuel level in vehicle (auto or bus) is measured analogously, by design and implementation of this project the fuel in the tank of vehicle is measured digitally and displayed on the LCD in digital numeric form. Then the GSM module sends the SMS to the owner about the location of fuel added from the received data of GPS module.

Conclusion

The Digital fuel indicator design like that described above will most likely be more accurate, more reliable, and cheaper than other analogue meters, and will allow for added features that benefit both the customer. In the near future, the different vehicle company manufacturers will implement this kind of fuel system which also provides security for the vehicle owners.

Future Scope

The applications in project have proved to be very important and it much required for the society. The project has the potential in it so that it gives way for future development of the project. In case of theft of vehicle, it can stopped 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.

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