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Determination of Adulteration and Quantity of Petrol using pH Meter and Microcontroller

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Abstract: In the industrial rebellion, the air pollution takes on the hike owing to fast growing use of fossil fuels. In developing countries like India, the automobile sector has developed as a key consumer of fuel and a key contributor to air pollution cause an increase in the greenhouse gases in the atmosphere results global warming leads to increased tailpipe emission and the consequent harm effects on public health. For the prevention of adulteration and monitoring of automobile fuel quality at the distribution point therefore, is highly important. Quantity and Quality of petrol is ensured, as it plays a major role in customer satisfaction. In addition, the petrol bunks require manual intervention for filling the petrol and collecting the cash. The unwanted fuel consumption by the public also leads to increase in cost of living. This paper aims to ensure the quantity and quality of petrol through duration of switching on the pump arrangement and voltage level of pH electrode. Concerning the benefit of the society based on the inflation, our government have to take necessary action to introduce petro cards which limits the per head fuel consumption according to the type of customer needs. In this paper for modelling purpose three different types of petro cards were designed based on the fuel need and essential needs of the public.

Keywords: Petrol, Adulteration, Ph Meter, Microcontroller, Petro Cards

I. INTRODUCTION

This paper aims to ensure the quantity and quality of petrol through duration of switching on the pump arrangement and voltage level of pH electrode. Concerning the benefit of the society based on the inflation, government have to take necessary steps to introduce petro cards which limits the per head fuel consumption according to the type of customer needs.

II. PETROL ADULTERATION DETECTION SYSTEM

In this experiment we use PIC microcontroller for implementation. The proposed system consists of pH electrode, Petro card, PIC microcontroller, pumping system and Display unit. pH electrode is used to determine the adulteration of petrol[1]. Petro cards are used for implementing automation in bunks and also limits the per head consumption of petrol through implementation of certain rules [2]. On-off time of the pumping system is used for ensuring the quantity and can be voice enabled [3].

It includes pH electrode, petro card module, Push buttons, pumping system, PIC Micro controller and LCD. pH electrode is a device that measures the pH Value of the liquid according to the H+ ion concentration present in it. The deviation from the desired pH value indicates the adulteration level in the petrol [4]. For pumping the fuel, rolling pump liquid type P08K04Rmodel has been used. Based on the duration of on-off time of the pumping system, the quantity is ensured. When the petro card is interfaced to the controller, the controller checks for card detail, customer type, initial balance and the amount to be deducted. Petrocard module consists of EEPROM that stores customer details and customer limitations. It enables data transfer by serial clock and serial data pins of port C through reader pin. These pins ensure data transfer between EEPROM memory and PIC microcontroller. There are two types of mode of operations which is operated using push buttons – read mode and top up mode. In read mode, the customer can enter the required quantity of petrol. In top up mode the top up of monthly and emergency balance for the particular month is done. The

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analog signal from pH electrode and the details on the petro card act as the input to the PIC controller (16F877A) enables the pumping system and displays the necessary details. The block diagram of the fuel adulteration detection system is shown in figure 1.

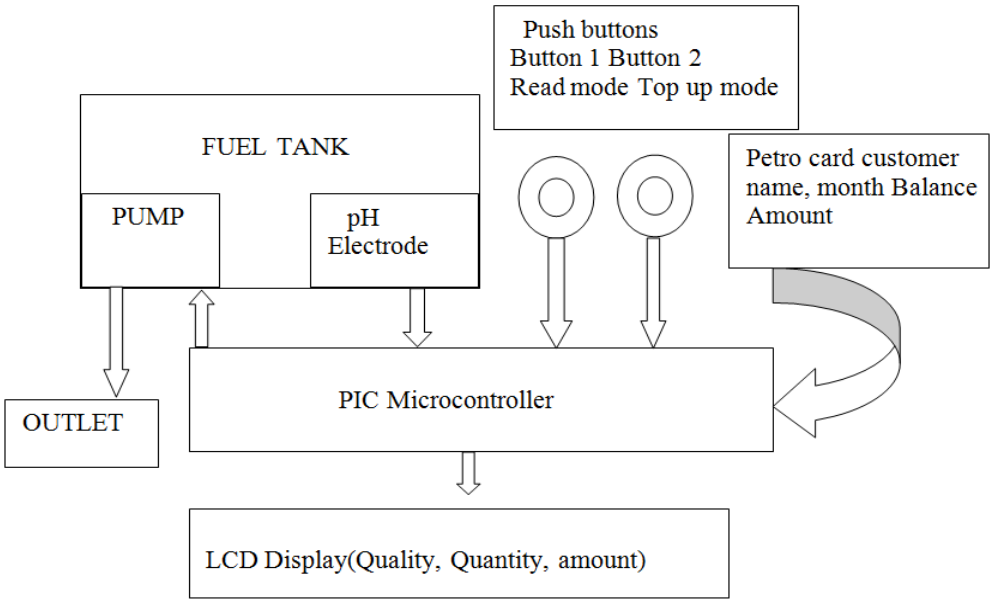

Fig.1. Block diagram of the process

III. TECHNICAL DESCRIPTION AND WORKING PRINCIPLE

Here PIC controller 16F877A with 20 MHz crystal frequency is interfaced with pH sensor through port A.0, read mode push button through port E.2, top up mode push button through port E.1, real time clock with crystal frequency 32 kHz through port B.1 to B.3, EEPROM through port C, pump through port B.7 via relay and LCD through port D[5], the data can also be validated using repeated transformations for accuracy. The pH electrode consists of reference electrode and measuring electrode. The reference electrode here used is silver- chloride. The solution is taken and tested for the pH value. According to presence of H+ ions there is variation in the potential value. The difference in the potential of the electrode is given to the Controller and the range of pH variation for different additive levels of ethyl alcohol are displayed in terms of voltage in the LCD display for user verification and safety digital lock provided for protecting data [6]-[9] . For pumping the fuel, rolling pump liquid type P08K04R model has been used. Based on the duration of on-off time of the pumping system, the quantity is ensured.

The microcontroller output voltage of 5V is insufficient. So, a Darlington transistor has been used for necessary amplification. Here Darlington transistor IC (ULN2003A) is a high current and high voltage IC that consists of seven Darlington transistor pairs to provide high output voltage. The EEPROM (24C02) provides a 2048 bits of serial electrically erasable programmable read only memory organized as 256 words of 8 bits each. Here 40 words of memory allocation are used where card details such as customer ID, month, initial balance and emergency balance are fed in addition limitation is provided for different users according to the usage of the customers there by reducing the per head consumption petrol. Fig.2 shows the pin configuration of EEPROM 24C02.The entire system can be interfaced with dc converter [10].

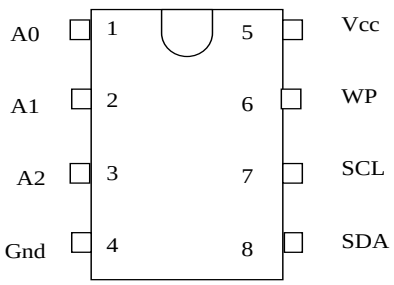

Fig.2. Pin Configuration of 24C02

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The enable pin possess a very simple function i.e., clock input for the LCD. For all practical purpose, the R/W pin has to be permanently connected to GND. Here LCD is connected with port D of the controller .Only 4 data pins are used for data transfer. Push buttons are used to enter the quantity of petrol required and for emergency top up. Here two push buttons are connected to port E. Working of push buttons is given in table 1.

Table 1: Push buttons operations

Mode Selection	Read Mode	Top up Mode
Button 1 Usage	Litre Selection	Amount Entry
Button 2 Usage	Not Used	Month Increment and Decrement

In LCD, Pins 1 and 2 are for the power supply. Pin1 is connected to ground and pin2 SS is connected to +5V power supply. Pin 3 is for adjusting contrast. Pins 7 to 14 are the Data pins of LCD. Pin 7 is the Least Significant Bit (LSB) and pin 14 is the Most Significant Bit (MSB). The Pins 15 and 16 are used for backlight adjustment. The 3 control pins used in LCD are: R/S, R/W and E.

IV. SIMULATION AND RESULTS

The quantity measurement is ensured through controlling the on-off time of the pump and based on the delivery pipe diameter of the pump. The on-off time duration for delivering various litres using rolling pump model P08K04R model was tabulated in the table 2. For future scope the rolling pump can be controlled with speed variations based on the requirement.

Table 2-ON-OFF Time of pump

Litres	Duration (sec)
1 litre	90
5 litres	450
10 litres	900

Quality was secured with the help of pH electrode where the pH value in terms of voltage for petrol varies depending on the amount of ethanol added to the petrol. The variation in the level of pH in terms of voltage for pure petrol is tabulated in the table 3

Table 3: PH value in terms voltage

Parameter	Iteration I	Iteration II
Voltage Level Corresponding to pH Value of Petrol	0.40 Mv	0.45 mV

The variation in the level of pH in terms of voltage for pure petrol lies between 0.40 to 0.45 mV. The pH electrode readings in terms of voltage for various quantity of ethyl alcohol are displayed in table 4.Result shows that the pH value of the mixture and its corresponding voltage level decreases while increasing the concentration of ethyl alcohol with petrol.

Table 4: Variation in ph value based on adulteration

Quantity of Petrol	Ethyl Alcohol	Variation in pH Value in Terms of Voltage
75 ml	25 ml	3.66 mV
75 ml	75 ml	0.31 mV
75 ml	125 ml	0.20 mv

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The pH value in terms of voltage of petrol is displayed in figure 3. The variation of pH value with different amount of ethanol in petrol is displayed in figures 4, 5 and 6.

Fig.3. pH Result 1

Fig4. pH Result 2

Fig.5. pH Result 3

Fig.6. pH Result 4

The following were the images that obtained on the process of simulation. The simulation were developed in PROTEUS 7.7 SP2 software that is shown in figure 7.

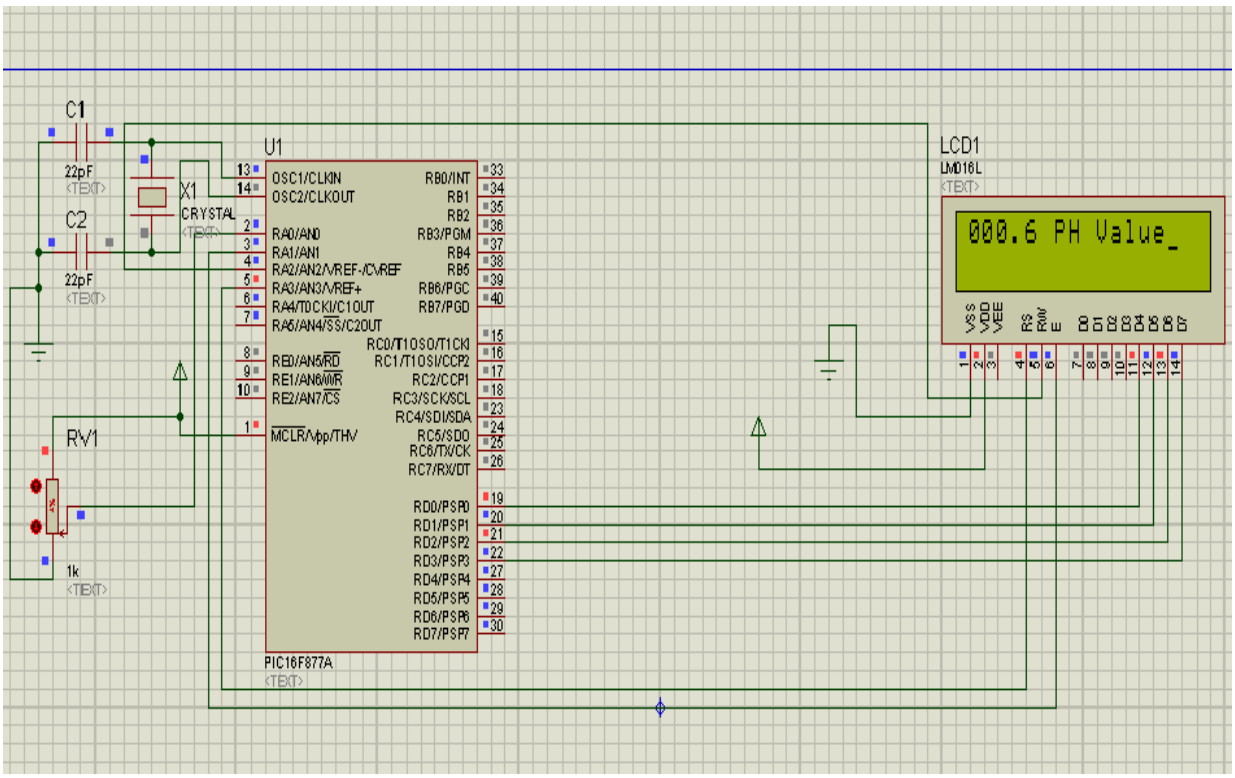

Fig.7. Simulation using proteus 7.7 SP2

Automated filling with limitation for per head consumption of petrol was implemented with the help of Petro cards for different types of customers. The customers are classified according to the availability of vehicles as two wheelers, four wheelers and heavy vehicles. The petro cards operate in two modes using push button switches namely top up mode and read mode. The top up mode was implemented for recharging their balance on monthly basis. The read mode was implemented for selecting the required quantity of petrol to be filled after checking the available balance and charging based on the type of customer and their limitations.

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V. CONCLUSIONS

In this paper a model to ensure the quality, quantity of petrol and atomization of petrol bunk was implemented successfully. The objective of the project is to limit the per head fuel consumption and make the public to use the common resources and avail petrol for emergency period. Especially this project would help the government to implement beneficial effects to the society. As an extension of this idea the price of the petrol can be automatically updated in the controller by using GSM module. Hence the price of the petrol comes into immediate effect once announced by the government. The petro cards can also be RF cards [11] for various customers can be updated and controlled by the government.

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