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Petroleum Quality Checker Using STM32F103C8T6 Microcontroller

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ABSTRACT: Petroleum Quality Checker is an equipment which automatically detects the quality of petroleum fuel by measuring the density of the give sample using a hydrometer,HC-SR04(ultrasonic sensor) and temperature using DS18B20(temperature sensor).The base module is designed using STM32F103C8T6 microcontroller.The values obtained are compared against a standard chart by the microcontroller and is displayed on an LCD screen as well as on user's smartphone.

KEYWORDS: Density ,Temperature, Hydrometer, Temperature Sensor, Android Application, Conversion chart

I.INTRODUCTION

Petroleum(petrol, diesel) is used extensively in modern life. But the petroleum we used today is not pure and the detection of adulterant is challenging. In India, it is well-known fact that the fuel pumps do not sell the pure and high quality petroleum products. The petrol pumps situated in national or state highways sell kerosene mixed petrol to the consumers. Oil producing companies in India have the strong policy to sell only the pure petrol or diesel in its pump but the distributors contaminate it. Mixed petrol or diesel harm the vehicle engine in a big way. Therefore,it is always advisable to test the purity of petrol or diesel before putting it in your vehicle. There are number of ways by which one can check the purity of petroleum:

1) Filter Paper Test

   Take a filter paper,put 2-3 drops of petrol over it. If the petrol is pure and is of good quality,it evaporates within little time leaving no mark or stain on the filter paper. If it leaves any stain or mark on the filter paper,then petrol is not pure and is of bad quality.

2) Density Check(to check petrol and diesel)

   It requires a 500ml jar, a hydrometer(measure the density of sample), a thermometer (check the temperature of sample) and ASTM(American Society for Testing of Materials) conversion charts. Fill 3/4th of the jar with the sample and dip the thermometer and hydrometer in the jar to record the values of temperature and density of the given sample. The value recorded are converted into density at 15 degree centigrade with the help of the conversion chart. This converted value is compared with the chart, if the difference is less than +/-3 then the product passes density test (i.e, the sample is pure)**.**

   The equipments or techniques used today are either too expensive or time consuming.

II.LITERATURE SURVEY

Fuel adulteration has become a very important and global issues nowadays.Adulteration or mixing of various substances causes degradation and reduces thequalityoffuel . Due to altering the properties of fuel, it doesn't meet the specifications as per requirement. Kerosene and diesel are the adulterants used in petrol[1].Anelectronictechniquetodetermineadulterationofpetrolbykerosene. In this method the light is guided inside an optical fiber in which optical fiber cladding is removed over a small length, thus the evanescent wave interacts with the measurand. The received light is converted into a proportional current and later into voltage[2]. We report for the first time the application of turnaround-point long period fiber gratings for wavelength encoded detection of automobile fuel adulteration. These specialty gratings can easily detect the presence of 1% contamination of kerosene in petrol.[3].The feasibility of detection/estimation of adulteration in gasoline and diesel using ultrasonic radiations has been proposed. The speed of ultrasound in non-adulterated and intentionally adulterated gasoline and diesel has been determined using pulse echo method. It has been observed that adulteration results in the change in the measured speed of ultrasound which can be calibrated in terms of percentage adulteration[4]. The proposed prototype uses Node MCU board with internet being remotely controlled by Android OS smart phone. Node MCU is the heart of this system and it can perform as a micro web server and it acts as an interface for the wide range of hardware modules. It is also used for environmental monitoring by sensing and analyzing data about temperature . All these activities are controlled by using

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Android mobile app-Blynk[5].This paper uses HCSRO4 to detect the water level of the tank. Certain levels are made fixed inorder to check the level of the water tank[6]. This paper introduces the characteristics and basic principle of 1-Wire digital thermometer DS18B20, and describes the design of its hardware and software for temperature measurement[7].The electronic hydrometer systems are of extreme use in industries and production plants of chemically and radioactively sensitive materials. In this paper electronically developed scheme has been proposed for measuring real time liquid density[8].The paper deals with a portable a monitoring system using STM32 chip and the Beidou navigation. It can collect real-time health parameters and send the coordinates of the user back[9].The adulterant that is mixed with petrol and diesel generally is kerosene. The reason why kerosene is chosen as an adulterant is its low cost. This adulteration results in reduced performance and lifetime of engine and other components of an automobile[10].

III.METHODOLOGY

The project consist of a temperature sensor (DS18B20),an ultrasonic sensor(HC-SR04),ahydrometer,an android application,a STM32F103C8T6 microcontroller and an ESP8266 WiFimodule.

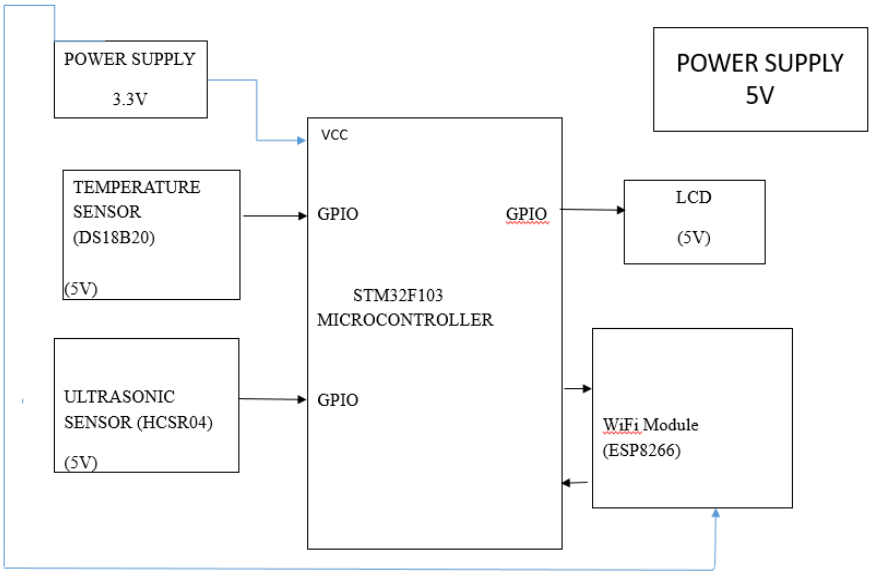

Fig .1 .Block Diagram

The DS18B20 temperature sensor is powered with a 5V DC and it is used to measure the temperature of the given sample.The output values are connected to the GPIO pin of STM32F103C8T6 microcontroller.The STM32F103C8T6 is a 48 pin microcontroller with a maximum operating frequency of 72MHz.The reason for choosing this is that it is much cheaper and faster than other microcontrollers available.

Now by using an ultrasonic sensor and a hydrometer, the distance from the sensor to the obstacle(piece of paper)placed at the top of hydrometer is measured.The values obtained are then compared against a standard chart (it consist of distance, temperature and density). ESP8266 WiFi module helps to connect the microcontroller with the android application.Thus the values obtained are displayed on user's smartphone as well as on an LCD display.

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IV.DESIGN OF THE SYSTEM

1.Hardware Design:

Fig .2 . Hardware

Temperature is measured by a temperature sensor (DS18B20),which is wrapped around the body (pipe) of the checker. Hydrometer reading is read by using an ultrasonic sensor kept at a fixed distance (here it is 20 cm) from the sample surface level. As the hydrometer moves up and down, the change in ultrasonic sensor reading is compared with the actual reading on the hydrometer.
These values are noted earlier to make a chart. And so one could easily use this table and compare to find hydrometer reading for different distances.The microcontroller STM32F103C8T6 use these readings(temperature,distance and hydrometer reading) and compare them with thestandard chart given by petroleum industry and find the density, thus the quality. The quality (density) values are displayed on both LCD as well as in smartphone (by a WiFi module).

2.Quality Checking:

For finding the quality(density), we are having a chart(from petroleum industry) on temperaturevs hydrometer readings, whose output gives the density of petrol at 15 degree centigrade.Temperature is measured by a temperature sensor(DS18B20). Hydrometer reading is read byusing an ultrasonic sensor(HC-SR04) kept at a fixed distance from the petrol surface level. Asthe hydrometer moves up and down, the change in ultrasonic sensor reading is compared withthe actual reading on the hydrometer.These values are noted earlier to make a chart. And so we could easily use this table and compare to find hydrometer reading for different distances. The microcontroller STM32F103C8T6use these readings(temperature,distance and hydrometer reading) and compare them with thestandard chart given by petroleum industry and find the density, thus the quality. The quality(density) value can be shown in a smartphone by a WiFi module and on LCD screen.
For experiment, we took two samples of diesel (400ml each). One, pure, with 400ml of pure diesel. Other, impure, with 380ml of pure diesel and 20ml of impurity. The adulterant or impurity used here are petrol and kerosene.

a)Pure diesel

For the pure sample at 29 degree centigrade ,we got 24cm reading in the ultrasonic sensor which correspond to 815 density. In the chart by petroleum industry, corresponding value of density at 15 degree centigrade is 824.

b) Impure diesel(380ml diesel + 20ml impurity)

For the impure sample at 30 degree centigrade , we got 29cm reading in the ultrasonicsensor which correspond to 808 density. In the chart by petroleum industry, corresponding value of density at 15 degree centigrade is 818.

V. EXPERIMENTAL RESULTS

For finding the quality(density and temperature),we have a chart (from petroleum industry) on temperature vs hydrometer reading , whose output gives the density of petroleum(diesel)at 15 degree centigrade.

From

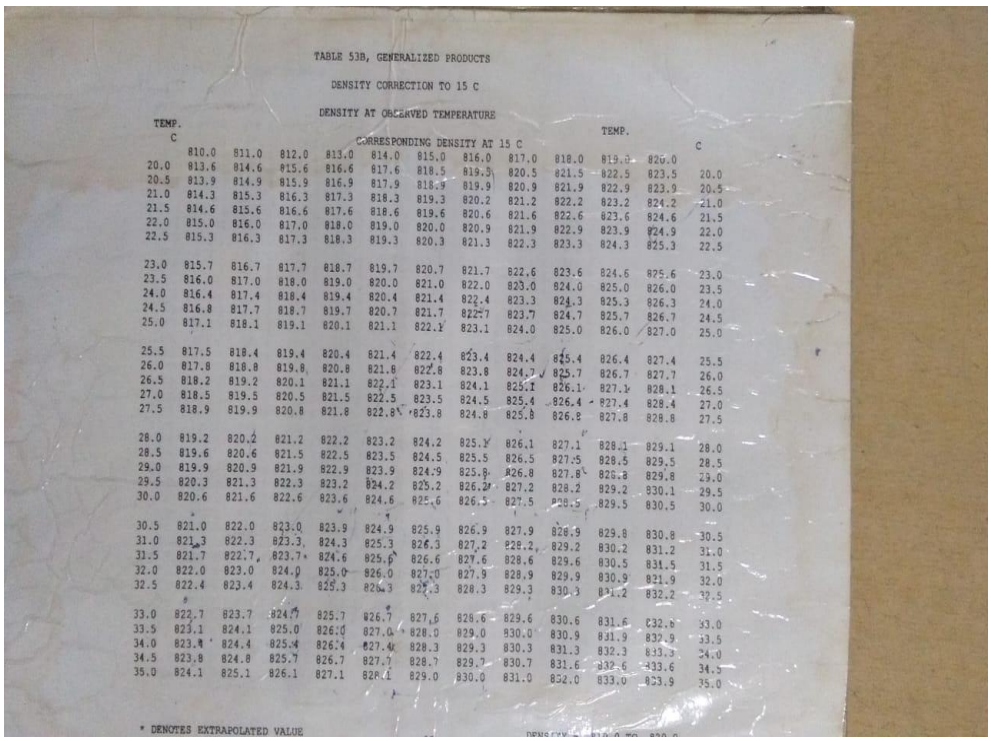

TABLE 53B, GENERALIZED PRODUCTS

DENSITY CORRECTION TO 15 C

DENSITY AT OBSERVED TEMPERATURE

TEMP. C	CORRESPONDING DENSITY AT 15 C											TEMP. C
	810.0	811.0	812.0	813.0	814.0	815.0	816.0	817.0	818.0	819.0	820.0	
20.0	813.6	814.6	815.6	816.6	817.6	818.5	819.5	820.5	821.5	822.5	823.5	20.0
20.5	813.9	814.9	815.9	816.9	817.9	818.9	819.9	820.9	821.9	822.9	823.9	20.5
21.0	814.3	815.3	816.3	817.3	818.3	819.3	820.2	821.2	822.2	823.2	824.2	21.0
21.5	814.6	815.6	816.6	817.6	818.6	819.6	820.6	821.6	822.6	823.6	824.6	21.5
22.0	815.0	816.0	817.0	818.0	819.0	820.0	820.9	821.9	822.9	823.9	824.9	22.0
22.5	815.3	816.3	817.3	818.3	819.3	820.3	821.3	822.3	823.3	824.3	825.3	22.5
23.0	815.7	816.7	817.7	818.7	819.7	820.7	821.7	822.6	823.6	824.6	825.6	23.0
23.5	816.0	817.0	818.0	819.0	820.0	821.0	822.0	823.0	824.0	825.0	826.0	23.5
24.0	816.4	817.4	818.4	819.4	820.4	821.4	822.4	823.3	824.3	825.3	826.3	24.0
24.5	816.8	817.7	818.7	819.7	820.7	821.7	822.7	823.7	824.7	825.7	826.7	24.5
25.0	817.1	818.1	819.1	820.1	821.1	822.1	823.1	824.0	825.0	826.0	827.0	25.0
25.5	817.5	818.4	819.4	820.4	821.4	822.4	823.4	824.4	825.4	826.4	827.4	25.5
26.0	817.8	818.8	819.8	820.8	821.8	822.8	823.8	824.7	825.7	826.7	827.7	26.0
26.5	818.2	819.2	820.1	821.1	822.1	823.1	824.1	825.1	826.1	827.1	828.1	26.5
27.0	818.5	819.5	820.5	821.5	822.5	823.5	824.5	825.4	826.4	827.4	828.4	27.0
27.5	818.9	819.9	820.8	821.8	822.8	823.8	824.8	825.8	826.8	827.8	828.8	27.5
28.0	819.2	820.2	821.2	822.2	823.2	824.2	825.1	826.1	827.1	828.1	829.1	28.0
28.5	819.6	820.6	821.5	822.5	823.5	824.5	825.5	826.5	827.5	828.5	829.5	28.5
29.0	819.9	820.9	821.9	822.9	823.9	824.9	825.8	826.8	827.8	828.8	829.8	29.0
29.5	820.3	821.3	822.3	823.2	824.2	825.2	826.2	827.2	828.2	829.2	830.1	29.5
30.0	820.6	821.6	822.6	823.6	824.6	825.6	826.5	827.5	828.5	829.5	830.5	30.0
30.5	821.0	822.0	823.0	823.9	824.9	825.9	826.9	827.9	828.9	829.8	830.8	30.5
31.0	821.3	822.3	823.3	824.3	825.3	826.3	827.2	828.2	829.2	830.2	831.2	31.0
31.5	821.7	822.7	823.7	824.6	825.6	826.6	827.6	828.6	829.6	830.5	831.5	31.5
32.0	822.0	823.0	824.0	825.0	826.0	827.0	827.9	828.9	829.9	830.9	831.9	32.0
32.5	822.4	823.4	824.3	825.3	826.3	827.3	828.3	829.3	830.3	831.2	832.2	32.5
33.0	822.7	823.7	824.7	825.7	826.7	827.6	828.6	829.6	830.6	831.6	832.6	33.0
33.5	823.1	824.1	825.0	826.0	827.0	828.0	829.0	830.0	830.9	831.9	832.9	33.5
34.0	823.4	824.4	825.4	826.4	827.4	828.3	829.3	830.3	831.3	832.3	833.3	34.0
34.5	823.8	824.8	825.7	826.7	827.7	828.7	829.7	830.7	831.6	832.6	833.6	34.5
35.0	824.1	825.1	826.1	827.1	828.1	829.0	830.0	831.0	832.0	833.0	833.9	35.0

* DENOTES EXTRAPOLATED VALUE

Fig. 3. Standard chart(density Vs Temperature)

Here we will add an additional column of distance(measured from HCSR04) in the chartmentioned above ,inorder to measure the purity.Since these values are constant independent of space and time for a given sample , wecould compare it with a standard to fix the quality.

From the experiment it is found that as **impurity increases density decreasesso distance increases**(as shown in chart below)

Distance(cm)	Corresponding density(kg/mˆ 3)
21	820
22	818
23	817
24	815
25	814
26	812
27	811
28	809
29	808
30	806

Table 1 : Chart(distance Vs density)

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By using the two above mentioned chart ,the petroleum quality checker automatically measure temperature and density, there by purity.

VI.CONCLUSION

This project was mainly concentrated to make an automatic cost effective petroleum quality checker when compared with the modern techniques(costly) and it consumes only very little time when compared with the traditional practices. The values are displayed on both LCD and user's smartphone.

REFERENCES

[1] Pranjali P Dharurkar and Arti R Wadhekar. "Estimation of petrol adulteration using statistical featureanalysisapproach". 2016InternationalConferenceonCircuit,PowerandComputing Technologies (ICCPCT), pages 1–4. IEEE, 2016.

[2] Anwar Sadat., "Fiber optic method to determine adulteration in petrol". 2013 Annual International Conference on Emerging Research Areas and 2013 International Conference on Microelectronics, Communications and Renewable Energy, pages 1–3. IEEE, 2013.

[3] Sanjay Kher, SmitaChaubey, Jai Kishore, and Shrikant M Oak,"Detection of fuel adulteration with high sensitivity using turnaround point long period fiber gratings in b/ge doped fibers" 2013 IEEE Sensors Journal, 13(11):4482–4486,

[4] RKSharmaandAnilKumar Gupta, "Detection/estimationof adulteration ingasoline and diesel using ultrasonics" 2007 International Conference on Industrial and Information Systems, pages 509–512. IEEE, 2007.

[5] K LovaRaju, V Chandrani ,SK Shahina Begum ,M Pravallika Devi, "Home Automation and Security System with Node MCU using Internet of Things" ,2019 InternationalConferenceon Vision Towards Emerging Trends in Communication and Networking,IEEE,2019

[6] M Reza Hidayat, SusantoSambasri, FirmanFitriansyah, Atik Charisma, HandokoRusianaIskandar, "Soft Water Tank Level Monitoring System Using Ultrasonic HCSR04 Sensor Based On ATMega 328 Microcontroller" 2019 IEEE 5th InternationalConferenceon Wireless and Telematics(ICWT)",IEEE,2019

[7] Zhou Runjing, XuHongwei, RenGuanzhong, "Design of Temperature Measurement System Consisted of FPGA and DS18B20",2011 International Symposium on Computer Science and Society,IEEE,2011

[8] P KalpanaMitra, PH Thyagaraju, SK Satpati, SB Roy, YS Ladola, " Density measuring system using magnetically actuated reed switch",2011 2nd InternationalConferenceon Instrumentation Control and Automation,IEEE,2011

[9] Xie Jing Wei, "Intelligent monitoring system based on STM32" 2017 IEEE 19thInternationalConferenceon e-Health Networking, Applications and Services(Healthcom),IEEE,2017

[10] V JershaFelx, PurohitamAdithyaUdaykiran, k Ganesan, "Fuel Adulteration Detection System"2015 Indian Journal of Science and Technology

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