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ULTRASONIC QUANTITATIVE AND QUALITATIVE SENSING FUEL MEASUREMENT

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ABSTRACT

In today's modern and digital world, if the fuel indicator in the vehicles is made digital, it will help us to know the exact amount of fuel available/filled in the tank. It can also help in knowing if the fuel dispensed is adulterated or not. The above fact is considered in our project. The exact amount of fuel available as well as presence of adulterant in the tank will be displayed digitally by making the use of Ultrasonic sensor. The ultrasonic sensor is a non-contact sensor, with low power requirement and good accuracy. It overcomes the problems faced by other gauges and is suitable for the non-contact measurement of the fuel inside the tank.
The device measures quantity and quality dispersed using simple ultrasonic waves. Hence, this device when installed prevents the customer from getting cheated.

KEYWORDS: adulterated, ultrasonic sensor, low power requirement, good accuracy, non-contact, cheated.

1. INTRODUCTION

General Theory of How Ultrasonic Sensing Works For single transducer in fluid level, fluid identification, and distance applications, the AFE excites the sensor and detects the echo once it returns, as shown in Figure. The AFE excites the transducer by hitting it with a series of pulses and with frequencies in the range of kHz to MHz. The AFE allows a maximum number of 31 pulses to excite the sensor, and its frequency can have a range from 31.25 kHz to 4 MHz. The excitation of the sensor is marked with a START pulse, while the echo is denoted with a STOP pulse. The difference in time between START and STOP time-of-flight (TOF) indicates the fluid level, fluid ID/concentration, and distance.

2. MATERIALS AND METHODS

- QUANTITATIVE ANALYSIS-- Ultrasonic AFE is ideal for many sensing applications. Figure shows a diagram for detecting fluid level in a container. Ultrasonic sensors are mounted on the bottom or top of the tank to determine the level of the fluid. The ultrasonic AFE excites the non-intrusive transducer with 1 to 31 pulses. The sensor continuously transmits pulses of high frequencies (typically 1 MHz) into the fluid. Then the reports the time-of-flight (TOF) that the wave takes to transmit to the liquid surface, and reflect back to the sensor. Referencing the speed of sound in the fluid and using the equation TOF = (2* fluid level) / (fluid speed of sound), the exact distance of the liquid surface from the sensor can be calculated with high accuracy.
- QUALITATIVE ANALYSIS-- Now, let's add to that level application, and see how fluid identification (ID) works. Fluid ID is the same as fluid level detection, except that the sensor is typically mounted on the side of the tank, as shown in Figure. Again, the AFE excites the sensor, and then it reports the time the wave takes to transmit and reflect back. Since the exact distance is known, and time-of-flight (TOF) is measured, the speed of sound through the fluid can be calculated, and checked against a lookup -table to identify the fluid.

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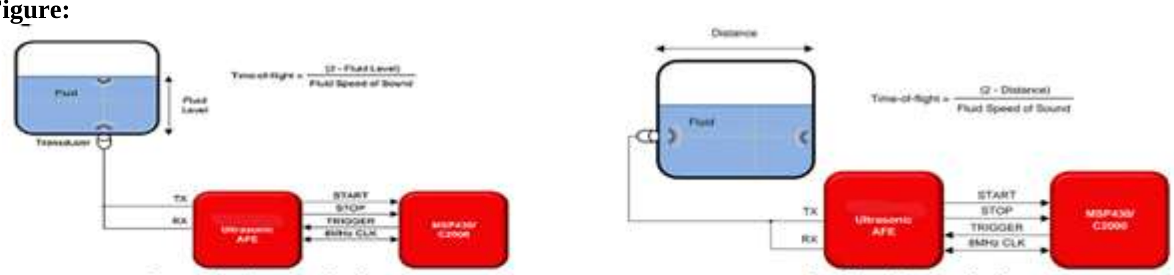
Figure:



Quantitative analysis *Qualitative analysis*

3. RESULTS AND DISCUSSION

Determining if the application can tolerate the transducer being mounted on the outside of the tank is the first start. Once this is known, a system designer can select a transducer with the appropriate package requirements and resonance frequency. Having properly mounted the transducer, TDC1000 can be connected to the transducer and application specific measurements can begin.

A more efficient and reliable sensing technology is the ultrasonic range sensing system with a microcontroller for quantitative and qualitative measurement thus **preventing the customer from getting cheated.**

Formulae:
CALCULATED FOR WATER –

The fluid level can be calculated as:
TOF = (2*fluid level) / (fluid speed of sound)
Fluid level = (TOF * fluid speed of sound) / 2
Fluid level = (1ms * 1207 m/s) / 2
Fluid level = 0.6035m

We can calculate the fluid speed of sound as:
TOF = (2*distance)/ (fluid speed of sound)
Fluid speed of sound = (2*distance) / (TOF)
Fluid speed of sound = (2*0.2 m) / (331 μs)
Fluid speed of sound = 1208.4 m/

Tables:

Petrol/Petrol + Kerosene	Density (kg/m³) at 28°C
Pure Petrol (allowable in India)	740-760
Petrol+ 10% Adulteration	765-770
Petrol+ 20% Adulteration	773-777
Kerosene	798-802

4. CONCLUSION

Ultrasonic sensing utilizing Time Of Flight (TOF) measurement techniques is used in liquid level and fluid identification sensing applications. In order to create a solution that is optimized for size, cost, and performance, one must first choose the right transducer for the application. Determining if the application can tolerate the transducer being mounted on the outside of the tank is the first start. Once this is known, a system designer can select a transducer with the appropriate package requirements and resonance frequency. Having properly mounted the transducer, TDC1000 can be connected to the transducer and application specific measurements can begin.

After brainstorming and researching we came to an agreement that the system is best solution for quality and quantity measurement at fuel station as well as in automobile industry.

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REFERENCES

[1] IOP Conf. Series: Materials Science and Engineering 128 (2016) 012026
[2] International Engineering Research Journal (IERJ) Volume 2 Issue 2 Page 848-850, 2016, ISSN 2395-1621
[3] International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 5, May 2016
[4] Texas instruments SNAA220A–March 2015–Revised June 2015
[5] AMENDMENT NO. 1 MARCH 2010 TO IS 2796 : 2008 MOTOR GASOLINE — SPECIFICATION
[6] www.iocl.com
[7] www.hindustanpetroleum.com
[8] International Research Journal of Engineering and Technology (IRJET)
SNAA266A–April 2015–Revised November 2015