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Dual Accurate and Digitized Fuel Scale for Mobikes

V. Ganesh[1], K. Mohan Kumar[2], R. Paul Mauriat[3] and K. Thirumalaivasan[4]

[1,2,3,4]Department of Electronics and Communication Engineering Achariya College of Engineering Technology Puducherry, India
E-mail: [1]ganpak2020@hotmail.com, [2]mohankumar.btech95@gmail.com, [3]paulmauria@gmail.com, [4]thirumalaivasankb@gmail.com

Abstract—*Every customer have right to know and claim about the commodity that they purchase. Frauds are common and inevitable in any purchase particularly with the essential that we consume in day to day life. Nowadays there is a major forgery taking place in fuel stations. Consumers are not receiving right quantity for the amount paid. In the fare for 3 litres, one is getting approximately 2.93 litres or less than that. In this case, there is a loss of 0.07 litre of fuel for a customer. One must think, if the customer size is 1000. To avoid this, a digitized dual accurate fuel scale is proposed and demonstrated in this paper. The effective way to measure the fuel inside the tank as well the fuel that receives from the fuel station is suggested and implemented.*

Keywords*: Indicator, ATMEGA microcontroller, LCD and float technique, flow technique.*

1. INTRODUCTION

Everything is being digitalized in the world (weighing machine, pressure indicator, RPM calculator, etc.), digitation of fuel gauge is just a dream. Recently, Government of India unveiled "The Digital India Project" by aiming to promote e-governance and transform India into a connected knowledge economy. In recent years everything will be connected to the internet through Internet of Things (IOT). A country's development is purely based on its economy. Our economy heavily depends on oil. On the consumer point of view, they pay more for what they get. This is due to the tax that is implied over the consumer by the distributers. This kind of problem can be overcome by developing the consumer awareness over the product. Such an awareness should be much familiar and easier for the consumer to use. In order to make up this in reality, some innovative electronic idea like the one given below can be implied for the welfare of the consumers. By this, some basic awareness over the product that the consumers utilize, is known to them and also the details about the basic service fare that is implied for the product. In India more than 90% of the oil agencies does not provide the exact amount of fuel [8] for which the consumer pay for. For example if a litre of oil purchased by a consumer is not actually the amount for which they have paid. Few percent of the oil purchased is hidden by the help of the agency's electronics stuff which is the only thing that is visible for the consumer to believe on the amount of oil that they have paid for. This kind of stuff can be handled by a consumer if and only if they have a smart option in their vehicles like the one that is mentioned below to know the amount of fuel they have purchased. There are many sensor base techniques available in the market to measure the liquid level and given you a close idea of quantity of the liquid, however this can provide you an exact approximation of quantity as in vehicles by fuel meters by which we can get an idea of whether tank is full, half full or empty etc[10].

This paper is organised as follows: The proposed system model and analysis of the fuel scale are discussed in section II. In section III, Characteristics of the system is presented. In section IV, Result and Discussion are discussed and concluding remarks is given in section V.

2. PROPOSED SYSTEM

2.1 Block Diagram

The function of the scale is fancied under the given block diagram illustrated in Fig. 1. The main blocks of the proposed system are Fuel Tank, Float Sensor, Flow Sensor, ADC (Analog to Digital Converter), ATMEGA Microcontroller and LCD (Liquid Crystal Display).

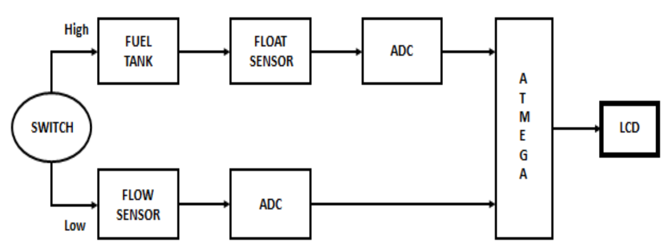

Fig. 1: Block diagram of proposed system

2.2 Decision switch

A switch is placed in the wall of the fuel tank of the vehicle in such a way that, it is high when fuel lid is closed and low when fuel lid is open. Based on the signal from this switch either loop1 or loop2 is chosen for high and low signal respectively. Here loop1 operates for float sensor and loop2 operates for flow sensor.

Both the sensors (Float, Flow) are not active at a time, thereby creating two different cases of operations as mentioned below (Table I)

Table I: Condition table

Float Sensor	Flow Sensor
ON	OFF
OFF	ON

2.3 Flow sensor

When the switch is low – When the lid of the tank is open, switch tends to be low. This switch is connected to Pin 6. Which calls the loop2 function. In this loop, the rate of flow of fuel is calculated with the help of an inbuilt motor, which is also a type of ADC convertor. Calculations are made respectively for conversion of flow rate into litres and it is formulated. This calculation may vary for every flow sensor depending on its inlet diameter. The net amount of fuel intake is displayed using LCD from the above calculations using flow sensor.

2.4 Float sensor

When the switch is high – When the lid of the tank is closed, switch tends to be high. This switch is connected to Pin 6. Which calls the loop1 function. In this loop, a basic model of variable resistor is used, in which one end of the coil is connected to +5V and the other end to ground. Float is connected to the variable Pin in accordance to which the output voltage is varied from 0V to 5V. If the float is in the bottom of the tank, the output is 0V. If the float is in top then, the output is 5V. Based on a trial and error method readings are taken for every 40ml and their corresponding voltages are noted. Later these voltage are converted as digital values from 0 to 1023 using an ADC. Using nested if else structure, an accurate value of fuel (in litres) is displayed from its respective ADC codes using a LCD.

The gauge which is used to indicate fuel level is called as float. This float is connected to the bike's battery indirectly. It acts as variable resistance i.e., when the tank is full, the resistance is low. Therefore, fuel indicator shows maximum (F) value and similarly when the tank is empty; the resistance is high; therefore, fuel indicator shows minimum (E) value. Let us use this resistance value to show the net fuel in litres present in the fuel tank. Since the resistance value obtained will be analog in nature (Present Fuel Indicator). We need digital signal to be processed in the micro controller. So, we use analog to digital converter to convert respective analog input to digitalized output. Converted digital value of analog input is equalized to the respective litre conversions. From the practical observation, we tabulate the ADC value (for the observed resistance value) to respective litres. We have tabulated the look up table for a two wheeler model (Table II).

Table II: Look up table for digitisation

S. No	ADC	Output(Litres)
1	Less than 457	Reserve
2	498	0.44
3	499	0.48
4	500	0.52
5	501	0.56
6	502	0.60
7	503-510	0.64
8	511-515	0.68
9	516-530	0.72
10	531-540	0.74
11	541-550	0.76
12	551-560	0.80
13	561-567	0.82
14	568-575	0.84
15	576-580	0.88
16	581-587	0.92
17	588-595	0.96
18	596-598	0.98
19	599-605	1.00
20	606-615	1.02
21	616-625	1.04
22	626-633	1.08
23	634-638	1.12
24	639-645	1.16
25	646-652	1.20
26	653-662	1.24
27	663-672	1.28
28	673-675	1.32
29	676-680	1.36
30	681-687	1.40
31	688-695	1.44
32	696-705	1.48
33	706-710	1.52
34	711-718	1.56
35	719-727	1.60
36	728-735	1.64
37	736-740	1.68
38	741-745	1.72
39	746-749	1.76
40	750-755	1.80
41	756-765	1.84
42	766-770	1.88
43	771-775	1.92
44	776-780	1.96
45	781-785	2.00
46	786-790	2.04
47	791-795	2.08
48	796-801	2.12
49	802-804	2.16

50	805-814	2.20
51	815-819	2.24
52	820-825	2.28
53	826-830	2.32
54	831-834	2.36
55	835-837	2.40
56	838-843	2.44
57	844-847	2.48
58	848-851	2.52
59	852-857	2.56
60	858-862	2.60
61	863-864	2.64
62	865-873	2.68
63	874-876	2.72
64	877-882	2.76
65	883-888	2.80
66	889-892	2.84
67	893-897	2.88
68	898-905	2.92
69	906-915	2.96
70	916-925	3.00
71	Greater than 926	Full

3. SYSTEM CHARACTERISTICS

Digital Fuel Indicator is implemented by the use of microcontroller, flow sensor and float sensor

1. Microcontroller ATMEGA 328-PU
2. Flow sensor
3. Float Sensor
4. B) LCD

1. Microcontroller

Atmel ATmega328 8-bit AVR® microcontrollers are high-performance RISC-based devices that combine 32KB ISP Flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, serial programmable USART, and more.

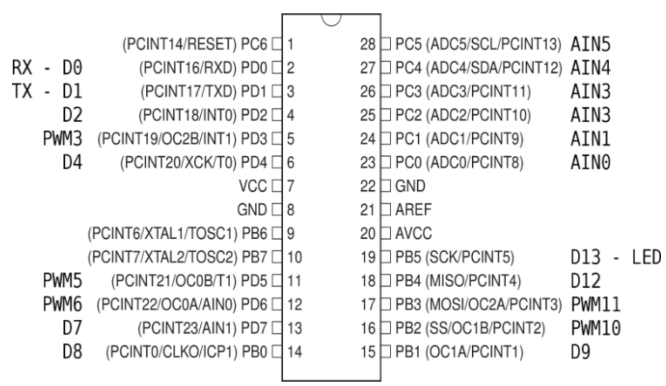

Fig. 2: Pin diagram of ATMEGA 328-PU.

Atmel ATmega328 MCUs execute powerful instructions in a single clock cycle, allowing the device to achieve throughputs approaching 1 MIPS per MHz while balancing power consumption and processing speed. These Atmel MCUs are designed for use in industrial automation and home and building automation. Pin diagram of Atmel ATmega328 PU is given in Fig. 2.

2. Flow Sensor

A flow sensor depiction in Fig. 3 is a device for sensing the rate of fluid flow. Typically a flow sensor is the sensing element used in a flow meter, or flow logger, to record the flow of fluids. As is true for all sensors, absolute accuracy of a measurement requires a functionality for calibration. There are various kinds of flow sensors and flow meters, including some that have a vane that is pushed by the fluid, and can drive a rotary potentiometer, or similar devices. Other flow sensors are based on sensors which measure the transfer of heat caused by the moving medium (Thermal mass flow meter). This principle is common for micro sensors to measure flow. Flow meters are related to devices called velocimetry that measure velocity of fluids flowing through them. Laser-based interferometry is often used for air flow measurement, but for liquids, it is often easier to measure the flow. Another approach is Doppler-based methods for flow measurement. Hall Effect sensors may also be used, on a flapper valve, or vane, to sense the position of the vane, as displaced by fluid flow.

Fig. 3: Flow sensor

3. Float Sensor

A Fuel Gauge portrait in Fig. 4 is an instrument used to indicate the level of fuel contained in a tank. Commonly used in most motor vehicles, these may also be used for any tank including underground storage tanks.

Fig. 4: Float sensor

4. LCD

An LCD display is specifically manufactured to be used with microcontrollers, which means that it cannot be activated by standard IC circuits. It is used for displaying different messages on a miniature liquid crystal display. It consists of 14 pins. There are 8 data pins to transfer the data to be displayed in the LCD. There are 3 other important pins namely RS, R/W, E which gives the instruction to LCD whether to read or wright the data. A 4 bit LCD is used to display the accurate content of fuel in the tank.

4. RESULT AND DISCUSSIONS

This accurate digital fuel indicator can be used in all automobiles. This will prevent all the forgery works in the fuel filling stations. We all know that, if we pay for a litre of fuel. We never get exactly 1 litre, instead of it we will only get 0.90 or 0.95 litre of fuel, rarely we get 1 litre.

Algorithm

- Analog value from the float inside the tank is digitalized to binary number.
- Each binary number has its equivalent digital voltage.
- Initialize LCD for displaying the data from the controller.
- Display the equalized litre value from the converted binary value.

This system is tested with a vehicle which doesn't have any provision for fuel scale in which basic analog fuel meter is not installed. It just has the support of analog speedometer. Output of the Flow sensor is visualized in Fig. 5. This output is only obtained while filling fuel in fuel station.

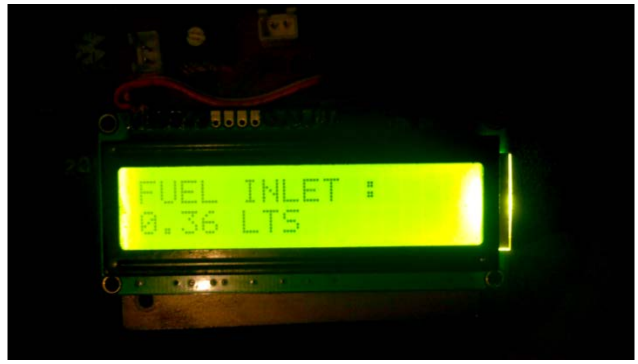

Fig. 5: Flow sensor Output

Output of the Float sensor is visualized in Fig. 6. This output is obtained anytime when the petrol lid is closed. This shows the exact amount of fuel present in the fuel tank of the vehicle.

Fig. 6: Float sensor Output

Comparison of the developed system with existing systems available in literature

The proposed and developed fuel scale's compared with the existing system in the literature which in terms of physical and functional parameters which is tabulated in Table III. It is evident from the table the proposed system is good in terms of accuracy, size, cost and compatibility.

Table III: Comparison

Parameter /Authors	Udayavalli et al (2014)	Vinashkumar et al (2014)	This system (2015)
Accuracy (ml)	-	100	10
Size (cm)	-	-	10×6
Compatibility	'N' number of sensors required	Difficult to Implement	Adoptable to any vehicle
Cost	-	-	Affordable
Microcontroller	8051	PIC	ATmega
Power usage	Most	More	Less

Future Work

In this paper, Quantity of fuel is ensured and digitalized. Likewise, Quality of the fuel will also be ensured in near future.

5. CONCLUSION

In this paper, a digitized and modified fuel scale system is proposed and implemented to avoid fuel frauds at fuel stations. This system will facilitate the customer to directly identify fuel frauds at filling stations. The developed system is compact, accurate and low cost than the fuel gauge available in the literature. This could be designed easily for any vehicle. Through this system one would know the fuel inside the tank as well the fuel that received from the fuel station.

REFERENCES

[1] Jaimon Chacko Varghese and Binesh Ellupurayil Balachandran, “Low Cost Intelligent Real Time Fuel Mileage Indicator for Motorbikes”, International Journal of Innovative Technology and Expoloring Engineering, Vol.2, No.5,April 2013, PP.97-101.

[2] A. Beaulieu, E. Foucault, P. Braudb, P. Micheaua and P. Szeger, “A flowmeter for unsteady liqid flow measurements”, Science Direct, January 2011, PP.131-137.

[3] R Rashmi and Rukmini Durgale, “The Novel of Embedded Based Digital Fuel Gauge”, International Conference on Computing and Control Engineering, April 2012.

[4] A.Avinashkumar, U.Singaravelan, T.V.Premkumar and K.Gnanaprakash “Digital fuel level indicator in two-wheeler along with distance to zero indicator”, Journal of Mechanical and Civil Engineering, Vol.11, No.2, April 2014, PP.80-84.

[5] Jaimon Chacko Varghese and Binesh Ellupurayil Balachandran, “Low Cost Intelligent Real Time Fuel Milage Indicator For Motorbikes”, International Journal of Innovative Technology and Expoloring Engineering, Vol.2, No.5, April 2013.

[6] Deep Gupta, Brajesh Kr. Singh and Kuldeep Panwar, “A Prototyping Model for Fuel Level Detector and Optimizer”, African Journal of Basic & Applied Sciences, Vol.4, No.2, 2012, PP.226-229.

[7] Udayavalli.V and Omamageswari. M, “Embedded System Based Intelligent Digital Fuel Gauge”, International Journal of Electronics & Communication, Vol.2, No.12, December 2014, PP.9-13.

[8] Awadhesh Kumar and Sandip Kumar Singh,” Digital Fuel Indicator in Two Wheelers”, International Journal for Scientific Research & Development, Vol.2, No.12, 2015, PP.290-293.

[9] Kunal D. Dhande , Sarang R. Gogilwar, Sagar Yele and Ass. Prof.Vivek Gandhewar , “Fuel Level Measurement Techniques: A Systematic Survey”, International Journal of Research in Advent Technology, Vol.2, No.4, April 2014, PP.81-84.

[10] Nitin Jade, Pranjal Shrimali, Asvin Patel and Sagar Gupta, “Modified Type Intelligent Digital Fuel Indicator System”, International Conference on Advances in Engineering & Technology, 2014, PP.20-23.

[11] Daniel R. McGlynn, “Vehicle Usage Monitoring And Recording System”, US Patent 4072850, February 1978.

[12] S.Kawamura, “Development of Navigation System”, Toyota Technology, Vol.34, December 1984.

[13] Ti-Ho Wanga, Ming-Chih Lua and Chen-Chien Hsu, “Liquid Level Measurement using a Single Digital Camera”, Elsevier, 42(4):604-610, 2009.

[14] Farrell G.Butler, “Gasoline Milege Indicator System”, US Patent 3958453, May 1976.

[15] Mr.Shakib Javed S.Shiekh, Mr.Sumit D.Chambhare, Prof.V.R. Gandhewar, Prof. Mahesh S. Grode, “Development and Fabrication of Alphanumeric Fuel Level Indicator for Two Wheelers”.

[16] Madhav Murthy, “Design and Fabrication of Digital Fuel Indicator for Two Wheelers”, International Conference on Design, Manafucturing and Mechatronic, 2014.

[17] Kosuge, et al, “Method and apparatus for indicating milege corresponding to remaining fuel for vehicles”, US Patent 4400779, August 1983.

[18] Betta, G.A. Pietrosanto and A.Scaglione, “Design of Digital Liquid Level Transducer Based on Opticalfiber”, IEEE Trans. Instrum. Meas., 45: 551-555, 1996.

[19] Attera Crop, “Creating Low-Cost Intelligent Display Modules with an FPGA and Embedded Processing”, V 1.0, September 2008.