Fuel Level Indicator for Automotive applications

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Table of Research Papers:

SR. NO.	TITLE OF THE PAPER	PUBLICATION DETAILS	APPROACH/ METHODOLOGY USED	INFERENCE/ COMMENTS
1	Digital fuel level indicator in two-wheeler along with distance to zero indicator	IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)	A mechanical float sensor is used to measure fuel level	Less complicated design
2	SMART DIGITAL FUEL INDICATOR SYSTEM	International Engineering Research Journal (IERJ)	The ultrasonic sensor is installed in the tank to sense the level of the petrol. And the Hall Effect sensor is used to count the rotation of the wheel	Accurate design

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Digital fuel level indicator in two-wheeler along with distance to zero indicator

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Abstract :*Today in this digitized world, if the fuel indicator in the automobiles is also made digital it will help to know the exact amount of fuel available in the fuel tank. The above furnished fact is considered in our project and we found out a proper solution for indicating the exact availability of fuel in the tank digitally . Here, we are indicating the amount of fuel in the tank in litres . This value in litres will be in numerical digits (ex:1.2, 1.3, 1.4). This project mainly concentrates about the indication of fuel level in two- wheeler tanks . Various other features like the distance can be travelled to the corresponding fuel , is added with this arrangement which will explain the clear performance of the vehicle to the corresponding fuel.*

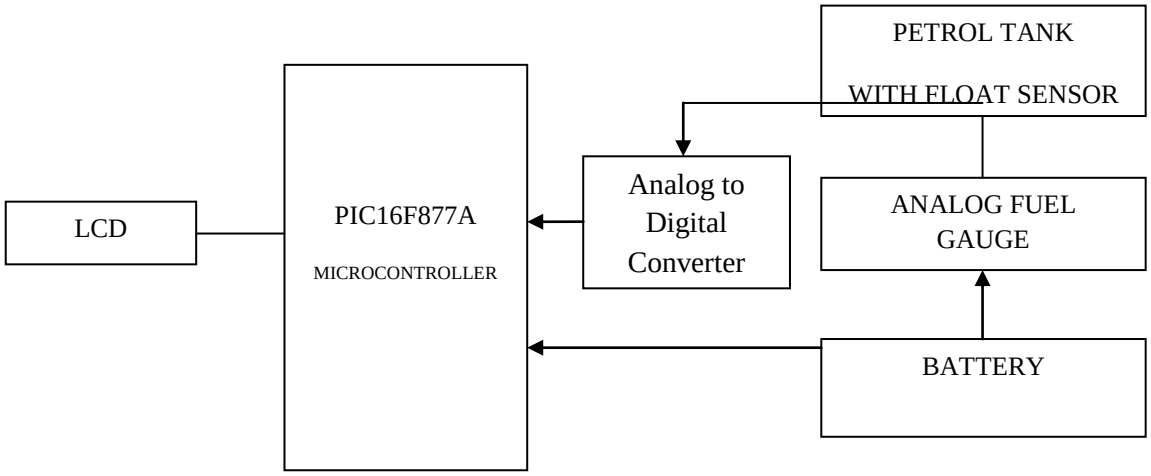
Keywords *:A/D Converter , Analog fuel gauge, Mileage, Two-wheeler.*

I. INTRODUCTION

The analog fuel gauge has two main units, namely the sending unit and the gauge. Here, when the fuel tank is full, resistance values decreases, current value increases and when the tank is empty, resistance values increases and current value decreases [1]. The rear side of the analog fuel gauge has three terminals, namely B-battery, F-float, G-ground. From these terminals, voltage values are taken from the terminals-FG and resistance value is taken from the terminal-F from zero to 11 litres. So, for a particular volt value, the corresponding litres value will be shown in digital [2]. Along with this, fuel mileage is also displayed in A/D Convertor to the corresponding fuel in the fuel tank. Fuel mileage in vehicles refers to the relationship between the distances can be travelled by an automobile to the amount of fuel in the fuel tank [3].

II. PROPOSED SOLUTION

This project focuses on creating a device which can help to actively display the exact amount of fuel and fuel mileage [4] of a motorbike in real time. It involves the making of the system to provide a mileage indicator which is reliable, easy to read and of dependable/compatible overall design. The system comprises of Fuel tank, Analog fuel gauge, Battery, A/D Converter [5] with LCD display [6].



III. COMPONENTS

Pic 16F877A Microcontroller

It is an 14-bit words microcontroller and has 8KB of Flash programmable and erasable read only memory. It has an operating frequency of DC-20Mhz.

LCD

LCD (Liquid Crystal Display) screen is an electronic display module and finds a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments.

Analog fuel gauge

It is a device which shows the amount of petrol in petrol tank .(EMPTY , HALF , FULL) .
It is used in most of the two-wheelers.

Petrol Tank with Float

It is used to store petrol in two-wheelers. Float is an object which sinks over the petrol inside the petrol tank to measure the amount of petrol left in the tank.

A/D Converter

It is a device which converts analog value into digital value.

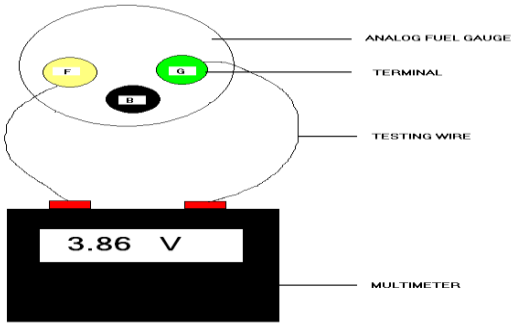
Battery

A 12 volt 7Ah battery is used to give supply to Analog fuel gauge , A/D converter along with LCD.

IV. EXPERIMENTATION METHOD

The rear side of the analog fuel gauge [7] has three terminals, namely F, G and B. From these terminals, we had taken terminals-FG as constant and collected the voltage values from those terminals to the corresponding litres in the petrol tank. By removing the terminal-F separately from the setup, we had taken resistance values from that terminal, to the corresponding litres in the petrol tank. The volt and resistance values was taken with the help of multi-meter. The current is obtained by using the formula, I = V/R.

Rear view of analog fuel gauge connected with multi meter to measure potentials at different fuel levels of tank as in figure



F - Float
G - Ground
B - Battery

Mileage obtained at various speed intervals

Here the mileage value is taken for 1 litre of petrol and the distance travelled [8] corresponding to it is tabulated below at various speed intervals.

SPEED	MILEAGE OBTAINED **(km/lt)**	
(km/hr)	SINGLE PERSON LOAD	DOUBLE PERSON LOAD
10	51	48
20	54	51
30	56	53
40	60	57
50	58	55
60	56	53
70	50	46
80	44	41
90	28	25

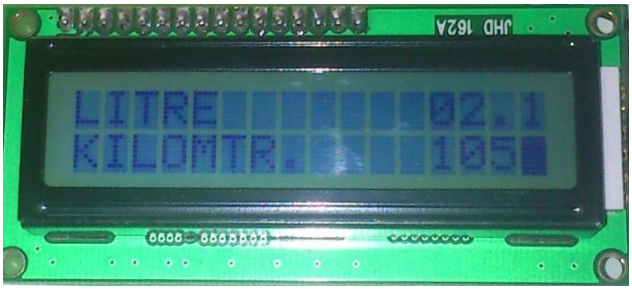
So , the average mileage for both single person and double person load will be around **50 (km/ltr).**

V. Description

In our project 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.

Here 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 [9] 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.

The LCD connected with vehicle which showing the present fuel level as 2.1 litres and the distance can be travelled as 105 Kilometer.



Most of the basic display unit will indicate empty, half, full with analog display [9] but the market available digital display units were displays the information in terms of percentage but our proposed method will displayed in terms of exact fuel level and these information are preprogrammed according to the sensor positional values(Resistance-Voltage). The proposed technique can be improved by adding a buzzer to announce the user about the abnormal conditions like low level, half level and full levels of the fuel tank.

In this project a float type sensor is placed within the fuel tank the variation of the fuel can change the position of variable resistance which is connected with the float. The varied resistance can change the voltage of the analog fuel level indicator to show the approximate value. But the variable resistance from the fuel tank is connected with the analog to digital converter unit to show the exact quantity of fuel in the fuel tank. The setup can show the exact value of fuel in the connected LCD and the setup is programmed to show the distance to zero by considering the rough mileage as 50kmpl. The distance to zero can also be an accurate by programming the microcontroller by taking the input of present mileage with respective speeds and tank levels.

Voltage, Resistance, Current and Distance to zero for various fuel levels is tabulated below ,

UEL I FUEL TANK (litres)	TERMINAL-F		DIGITS CONSID (Volts)	ESISTANC VALUES IN (ohms)	CURREN OBTAINE (amps)	ISTANC TO ZERC (KM)
	MIN (volts)	MAX (volts)				
<1.0	3.82	4.00	3.83 to 3.82	<89.5	< 0.0425	< 50
1.0	3.81	4.00	3.81	89.5	0.0425	50
1.1	3.79	4.00	3.80 to 3.79	88.26	0.0430	55
1.2	3.77	4.00	3.78 to 3.77	87.02	0.0434	60
1.3	3.75	4.00	3.76 to 3.75	85.78	0.0438	65
1.4	3.73	4.00	3.74 to 3.73	84.54	0.0442	70
1.5	3.71	4.00	3.72 to 3.71	83.3	0.0446	75
1.6	3.69	4.00	3.70 to 3.69	82.06	0.0450	80
1.7	3.67	4.00	3.68 to 3.67	80.82	0.0455	85
1.8	3.65	4.00	3.66 to 3.65	79.58	0.0459	90
1.9	3.63	4.00	3.64 to 3.63	78.34	0.0464	95
2.0	3.61	4.00	3.62 to 3.61	77.1	0.0469	100
2.1	3.59	4.00	3.60 to 3.59	75.97	0.0473	105
2.2	3.57	4.00	3.58 to 3.57	74.84	0.0478	110
2.3	3.55	4.00	3.56 to 3.55	73.71	0.0482	115
2.4	3.53	4.00	3.54 to 3.53	72.58	0.0487	120
2.5	3.51	4.00	3.52 to 3.51	71.45	0.0492	125
2.6	3.49	4.00	3.50 to 3.49	70.32	0.0497	130
2.7	3.47	4.00	3.48 to 3.47	69.19	0.0502	135
2.8	3.45	4.00	3.46 to 3.45	68.06	0.0508	140

FUEL I FUEL TANK (litres)	TERMINAL-F		DIGITS CONSID (Volts)	ESISTANC VALUES I (ohms)	CURREN OBTAINE (amps)	ISTANC TO ZERC (KM)
	MIN (volts)	MAX (volts)				
6.0	2.81	4.00	(2.82 to 2.81)	38.5	0.0732	300
6.1	2.79	4.00	(2.80 to 2.79)	37.8	0.0740	305
6.2	2.77	4.00	(2.78 to 2.77)	37.1	0.0749	310
6.3	2.75	4.00	(2.76 to 2.75)	36.4	0.0758	315
6.4	2.73	4.00	(2.74 to 2.73)	35.7	0.0767	320
6.5	2.71	4.00	(2.72 to 2.71)	35	0.0777	325
6.6	2.69	4.00	(2.70 to 2.69)	34.3	0.0787	330
6.7	2.67	4.00	(2.68 to 2.67)	33.6	0.0797	335
6.8	2.65	4.00	(2.66 to 2.65)	32.9	0.0808	340
6.9	2.63	4.00	(2.64 to 2.63)	32.2	0.0819	345
7.0	2.61	4.00	(2.62 to 2.61)	31.5	0.0831	350
7.1	2.59	4.00	(2.60 to 2.59)	30.91	0.0841	355

2.9	3.43	4.00	3.44 to 3.43	66.93	0.0513	145
3.0	3.41	4.00	3.42 to 3.41	65.8	0.0519	150
3.1	3.39	4.00	3.40 to 3.39	64.78	0.0524	155
3.2	3.37	4.00	3.38 to 3.37	63.76	0.0530	160
3.3	3.35	4.00	3.36 to 3.35	62.74	0.0535	165
3.4	3.33	4.00	3.34 to 3.33	61.72	0.0541	170
3.5	3.31	4.00	3.32 to 3.31	60.7	0.0546	175
3.6	3.29	4.00	3.30 to 3.29	59.68	0.0552	180
3.7	3.27	4.00	3.28 to 3.27	58.66	0.0559	185
3.8	3.25	4.00	3.26 to 3.25	57.64	0.0565	190
3.9	3.23	4.00	3.24 to 3.23	56.62	0.0572	195
4.0	3.21	4.00	3.22 to 3.21	55.6	0.0579	200
4.1	3.19	4.00	3.20 to 3.19	54.69	0.0585	205
4.2	3.17	4.00	3.18 to 3.17	53.78	0.0591	210
4.3	3.15	4.00	3.16 to 3.15	52.87	0.0597	215
4.4	3.13	4.00	3.14 to 3.13	51.96	0.0604	220
4.5	3.11	4.00	3.12 to 3.11	51.05	0.0611	225
4.6	3.09	4.00	3.10 to 3.09	50.14	0.0618	230
4.7	3.07	4.00	3.08 to 3.07	49.23	0.0625	235
4.8	3.05	4.00	3.06 to 3.05	48.32	0.0633	240
4.9	3.03	4.00	3.04 to 3.03	47.41	0.0641	245
5.0	3.01	4.00	3.02 to 3.01	46.5	0.0649	250
5.1	2.99	4.00	(3.00 to 2.99)	45.7	0.0656	255
5.2	2.97	4.00	(2.98 to 2.97)	44.9	0.0663	260
5.3	2.95	4.00	(2.96 to 2.95)	44.1	0.0671	265
5.4	2.93	4.00	(2.94 to 2.93)	43.3	0.0678	270
5.5	2.91	4.00	(2.92 to 2.91)	42.5	0.0687	275
5.6	2.89	4.00	(2.90 to 2.89)	41.7	0.0695	280
5.7	2.87	4.00	(2.88 to 2.87)	40.9	0.0704	285
5.8	2.85	4.00	(2.86 to 2.85)	40.1	0.0713	290
5.9	2.83	4.00	(2.84 to 2.83)	39.3	0.0722	295
7.2	2.57	4.00	(2.58 to 2.57)	30.32	0.0850	360
7.3	2.55	4.00	(2.56 to 2.55)	29.73	0.0861	365
7.4	2.53	4.00	(2.54 to 2.53)	29.14	0.0871	370
7.5	2.51	4.00	(2.52 to 2.51)	28.55	0.0882	375
7.6	2.49	4.00	(2.50 to 2.49)	27.96	0.0894	380
7.7	2.47	4.00	(2.48 to 2.47)	27.37	0.0906	385
7.8	2.45	4.00	(2.46 to 2.45)	26.78	0.0918	390
7.9	2.43	4.00	(2.44 to 2.43)	26.19	0.0931	395
8.0	2.41	4.00	(2.42 to 2.41)	25.6	0.0945	400
8.1	2.39	4.00	(2.40 to 2.39)	25.12	0.0955	405
8.2	2.37	4.00	(2.38 to 2.37)	24.64	0.0965	410
8.3	2.35	4.00	(2.36 to 2.35)	24.16	0.0976	415
8.4	2.33	4.00	(2.34 to 2.33)	23.68	0.0988	420
8.5	2.31	4.00	(2.32 to 2.31)	23.2	0.1	425
8.6	2.29	4.00	(2.30 to 2.29)	22.72	0.1012	430
8.7	2.27	4.00	(2.28 to 2.27)	22.24	0.1025	435
8.8	2.25	4.00	(2.26 to 2.25)	21.76	0.1038	440
8.9	2.23	4.00	(2.24 to 2.23)	21.28	0.1052	445
9.0	2.21	4.00	(2.22 to 2.21)	20.8	0.1067	450
9.1	2.19	4.00	(2.20 to 2.19)	20.43	0.1076	455
9.2	2.17	4.00	(2.18 to 2.17)	20.06	0.1086	460
9.3	2.15	4.00	(2.16 to 2.15)	19.69	0.1097	465
9.4	2.13	4.00	(2.14 to 2.13)	19.32	0.1107	470
9.5	2.11	4.00	(2.12 to 2.11)	18.95	0.1118	475
9.6	2.09	4.00	(2.10 to 2.09)	18.58	0.1130	480
9.7	2.07	4.00	(2.08 to 2.07)	18.21	0.1142	485
9.8	2.05	4.00	(2.06 to 2.05)	17.84	0.1154	490
9.9	2.03	4.00	(2.04 to 2.03)	17.47	0.1167	495
10.0	2.01	4.00	(2.02 to 2.01)	17.1	0.1181	500
10.1	1.99	4.00	(2.00 to 1.99)	16.84	0.1187	505
10.2	1.97	4.00	(1.98 to 1.97)	16.58	0.1194	510
10.3	1.95	4.00	(1.96 to 1.95)	16.32	0.1200	515
10.4	1.93	4.00	(1.94 to 1.93)	16.06	0.1207	520
10.5	1.91	4.00	(1.92 to 1.91)	15.8	0.1215	525
10.6	1.89	4.00	(1.90 to 1.89)	15.54	0.1222	530
10.7	1.87	4.00	(1.88 to 1.87)	15.28	0.1230	535

10.8	1.85	4.00	(1.86 to 1.85)	15.02	0.1238	540
10.9	1.83	4.00	(1.84 to 1.83)	14.76	0.1246	545
11.0	1.81	4.00	(1.82 to below 1.82)	14.5	0.1255	550

VI. CONCLUSION

The A/D converter with LCD was fitted with the Analog fuel gauge of the two-wheeler and the result was successfully obtained. The A/D converter shows the amount of fuel in fuel tank in exact litres (EX : 1.3, 1.4, 1.5). The A/D converter shows the exact fuel in litres only when the the fuel in the fuel tank is more then 1 litre. The accuracy level is upto95 – 98% because the error was around ± 0.2 litres, because the fuel in the fuel tank was measured on the basis of float level in the tank and we didn't use any other sensors. It displays the exact litres on plane roads and shows error value on slope surfaces.

VII. Future Enhancements

In future the proposed technique can be improved by adding fuel cells at different places of fuel tank to measure exact fuel levels at different conditions like day/night for particular densities at different altitude conditions of vehicle and a buzzer to announce the user about the abnormal conditions like low level, half level and full levels of the fuel tank to refill or warn themselves. The accurate distance to zero can also be done by programming the microcontroller by taking the input of present mileage with respective speeds and tank levels.

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SMART DIGITAL FUEL INDICATOR SYSTEM

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ABSTRACT

Today in this digitized world, if the fuel marker in the vehicles is additionally made advanced. It will know the correct measure of fuel accessible in the fuel tank. Here, we are showing the measure of fuel in the tank in liters. This incentive in litters will be in numerical digits (ex: 1.2, 1.3 and 1.4). This project predominantly focuses about the sign of fuel level in bike tanks and predicting the user location by using latitude and longitude value which is send by GPS to the system. This project evades a great deal of issues like fuel bunks at fuel stations, fuel burglary and keeps us from getting into circumstances where we need to push our vehicles because of suppositions of the level of fuel. These days the fuel pointer framework for the bikes are computerized yet they don't show the correct measure of fuel which is available in the tank i.e. they demonstrate the measure of fuel as far as bars and not in numbers or digits like liters or Milliliter. So this issue is contemplated for our work of building up the computerized (numeric) fuel pointer framework for bikes which indicates correct measure of fuel regarding Liters (L) or Milliliters (ml).

Keywords: PIC16F877A Microcontroller, Ultrasonic sensor, Hall effect sensor, LCD (20*4 Character), GPS Module

I. INTRODUCTION

The current fuel demonstrating framework in vehicle utilizes simple and computerized visuals for indicating surmised status of fuel level, not displaying the amount in numerical. This framework alluded demonstrates the fuel level in numerical by utilizing LCD. In India, mileage issue has risen to be a major issue prompting clients stalling out in obscure zone since they neglect to check the fuel level. This proposed configuration can give an approach to stop this issue and control the exorbitant utilization of the fuel to the client by demonstrating mileage. This proposed configuration will be useful to control the stream of the fuel in the vehicle, additionally persistently shows the fuel left and the kilometre it can cover. This is finished by controlling the fuel use with the assistance of units put in the fuel tank and when the fuel tank gets unfilled a sign is given for the driver that the fuel is void and the vehicle will kill. On the premise of PIC 16F877A advancement of this plan is done and to demonstrate the fuel that is available in the vehicle LCD show is utilized as yield unit. The Characters got from the controller unit is recently shown and in addition the fuel level and the separation it can travel, so that the client can drive at the existing fuel.

II. LITERATURE SURVEY

Authors in [1] suggests that, With the increase of vehicle usage over the world, fuel necessary has become a tremendous problem. Design and implementation of load cell based fuel measurement measures the accurate level of fuel adding while fuel filling process. There is a large variety of methods for measuring fuel level, ranging from those using mechanical floats and capacitive and optical sensors to ultrasound methods. Nowadays all fuel bunks having types of digital displays unit in order to display the value of fuel adding to the vehicle. But the disadvantage of using load cell is that it can't be used for measurement of highly reactive material such as petrol. So we decided to use ultrasonic technique for petrol level measurement as it is a non –contact type measurement method.

Author [2] suggests that, In all over the world all the vehicle are having an analog fuel meter. This meter indicates three states of fuel level which are empty, half and

Full. So we cannot judge the actual fuel present in the fuel tank. In Fig1 we can see analog meter, which shows the fuel level by using needle. But due to this we do not get proper idea about fuel level present in fuel tank. Due to improper knowledge of fuel present in the tank we can undergo in trouble due to low fuel.

Fig 1: Analog Fuel Meter

As considering previous analog system we are going to implement advanced system. In our system we are doing digital fuel meter and theft detection. In digital fuel meter we are indicating the amount of fuel in the tank in liters. This value in liters will be in numerical digits (Ex: 1 lit, 1.5 lit, 2 lit).

III. RELATED WORK

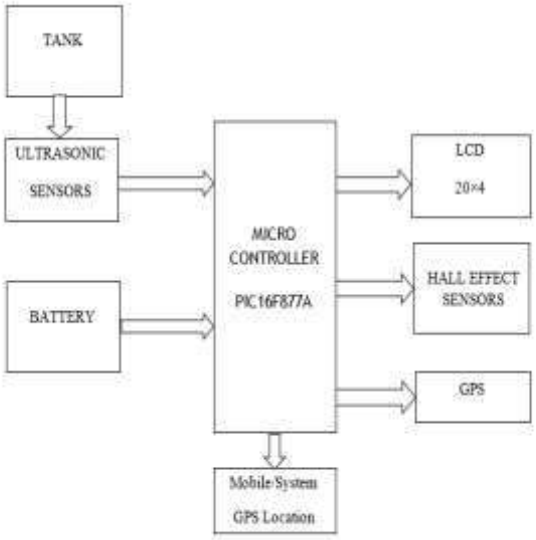

Fig 2.Block diagram of digital fuel indicator system

In the system, the microcontroller PIC18f877A is used. This controller is extremely helpful to utilize, the coding or programming of this controller is additionally simpler. PIC16f877A finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and in many industrial instruments.

The sensors that are used is Hall Effect sensor and ultrasonic sensor.

The ultrasonic sensor is installed in the tank to sense the level of the petrol. And the Hall Effect sensor is used to count the rotation of the wheel. The GPS is used to get the location of the user.

The working of the system is, the ultrasonic sensors which are installed in the tank use to sense the level of petrol and send it to the controller, the controller will show that level in digital (numeric) form like (1.2, 2.2, 5.4etc) on the 20*4 LCD display.

Fig 3: LCD (20*4 Character)

Also the rotation of the wheel is counted by the Hall Effect sensor using magnet which is place over it and these pulse are given to the controller.

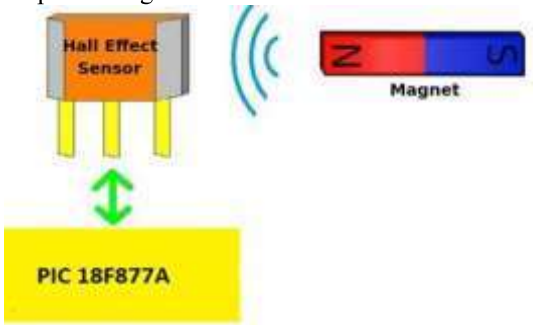

Fig 4. Hall Effect sensor with PIC18F877A

According to that, the LCD which is connected to the controller shows the speed, mileage, fuel level and estimated distance is displayed on the LCD.

The additional GPS circuitry is used to provide location of user, by using latitude and longitude of corresponding area of user. GPS fetching the latitude and longitude value of the user location and send it to the system. The Apache Software is used to fetch the latitude and longitude values and MY SQL software is used to store the data of the user location in the web server, and display on the map.

Fig 5: GPS Module

IV. RESULT

The system shows the following values:

1. Fuel in Liter 2.Est.Distance
3. KMph (per hour) 4.KMpl (per liter)

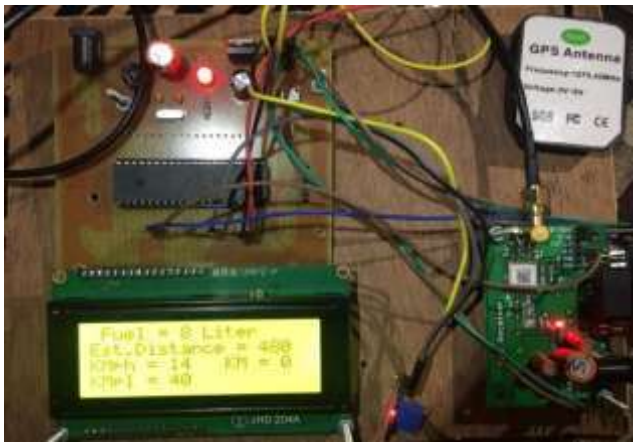

Fig 6: Digital Fuel Indicator System With Parameter Indication

LCD shows the Latitude and Longitude value of the user Location, the GPS Antenna monitor the latitude and longitude value of the User Location and these values will be sent to the system com port.

Fig 7. Showing the latitude and longitude value on the LCD Fig. below shows the actual location of the user on the map.

by using latitude and longitude value of the user which is sent by the controller using GPS to the com port of the system.

Fig 8:The actual location of the user by using latitude and longitude which is sent by the controller using GPS to the com port of the system.

V. CONCLUSION

The smart digital fuel indicator is very advance type indicating system. The main advantage of this system is that it can gives accurate value of remaining fuel as well as the vehicle running capacity in km. The operation time taken is very less. All the equipment's have long life, durable & quality material. This project is able to show that simple available hardware and technology can be used to construct a robust fuel level monitoring system. It also shows the location of vehicle to the user by using the latitude and longitude value. The system designed and tested in this project presented at the low construction cost of the system .Involving mechatronics in such design applications can eventually solve many practical problems with ease, reliability and at low cost.

Even though the quality of material used and components used are of good quality, the cost of the project is not so costly and it can be used and implemented in all vehicles without much increment of cost of the vehicle. This smart fuel indicator is best in its field and will be most widely used and advance system.

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