DIGITAL FUEL METER USING ARDUINO

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Abstract: As we have seen that in this digitized world we need real time digital reading of any measured parameter for greater precision to steer clear of any swindles. In order to do so in the field of automobiles, we concentrate on one of the aspects, the fuel measuring and display system. The reason being, fuel station frauds which could occur while filling up our fuel tanks. In this project we aim to achieve a digital reading of the fuel present in the vehicle tank. Distance to empty is an additional feature which can be useful in showing the distance a vehicle can cover with the fuel present in the tank. With the digital reading of the quantity of the fuel present we can accurately determine the mileage by formulating with the exact quantity of fuel in the tank and obtaining the precise distance the vehicle can travel. Considering the above factors, we have designed a working prototype model.

Keywords: Arduino UNO, HX711 Amplifier Module, Load Cell

1. INTRODUCTION

An automobile fuel tank is one of the most important components for an automobile system to function being an internal combustion engine. With the passing years, the consumption of fuel is increasing magnanimously and the requirement to know the amount of fuel present in our fuel tanks is also critical. As the price of fuel is shooting up day by day, it is our need to have an exact knowledge of the fuel present in the tanks precisely.

When filling up at fuel stations in our vehicles, the fuel dispensers might be faulty or the station itself might be running a rigged fuel dispenser for their profit. While doing so the reading shown on the fuel dispenser display at the fuel station could deceive us and the conventional digital meters in the most of the vehicles have a pointer system or shows bar points which indicate a vague amount of fuel filled which have no exact specification of the quantity of fuel. These types of readouts make it difficult to determine the exact amount of fuel present in the tank. Entering the digital world that we live in, it is essential for us to have a display of an error-free digital fuel measuring device.

Distance to empty is a parameter which shows the distance the vehicle can cover with the fuel present. This is another parameter which can be determined accurately when the exact digital measurement of the fuel is present in the tank as mileage can be formulated with the amount of fuel present and give the precise distance the vehicle can travel.

2. PROBLEM STATEMENT

When filling up fuel at fuel stations, we do not know if the exact amount of fuel shown on their dispenser is true or not, as the fuel meter currently being used does not show the fuel filled or fuel present in the tank digitally. A float sensor setup with a resistive variation connected to a circuit is the arrangement by which the fuel present in the tank is being displayed.

We have come up with a method to design a fuel metering system that can account for the exact amount of fuel present in the tank digitally in number readout i.e., in Liters up to two sigma accuracy and also display the distance to empty by average fuel consumption formulation.

3. DEVELOPMENT OF SYSTEM / METHODOLOGY

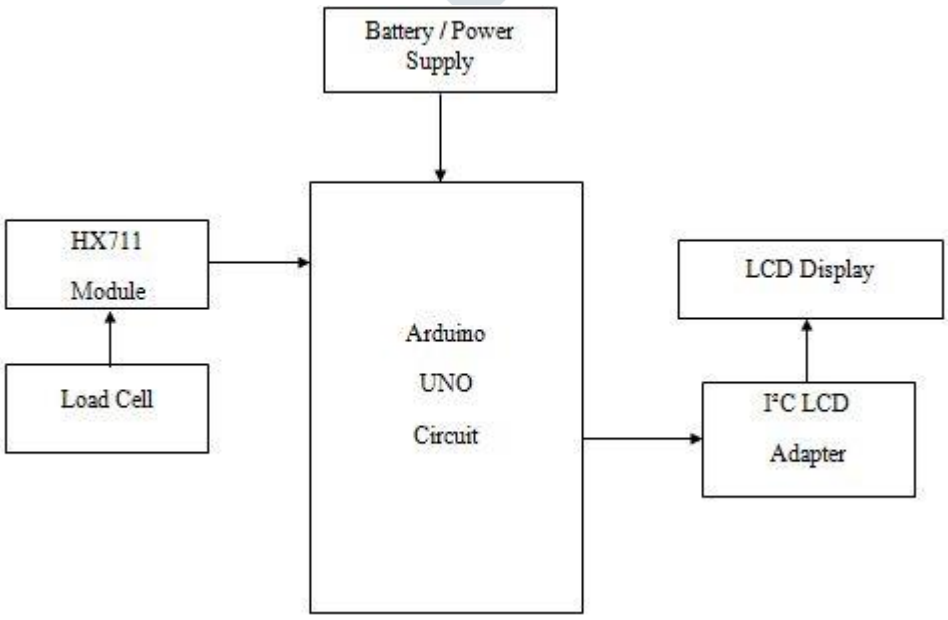

Fig 1: Block Diagram of System

3.1 Components Used:

3.1.1 Arduino UNO Circuit
3.1.2 Load Cell (40Kg)
3.1.3 HX711 Module (Amplifier)
3.1.4 LCD Display (16*2)
3.1.5 I^2C LCD Adapter

3.1.1 Arduino UNO Circuit: It is a microcontroller board based on the ATmega328. Arduino UNO is an open source, prototyping platform which is simple and very easy to formulate programs for a wide range of applications making it ideal. The Arduino Uno has 14 digital input and output pins, 6 (six) analog inputs, 16 Mega Hz crystal oscillator, USB connection, power supply, In circuit serial programming (ICSP) header and a reset button.

3.1.2 Load Cell: It is a transducer that converts a load or force acting on it into an electronic signal. This electronic signal generated can be a current change, voltage change or frequency change depending on the type of load cell and circuitry used. Magnitude of this electrical output is directly proportion to the force being applied. Load cells have strain gauges which deforms when force is applied on it and then strain gauges generate electrical signal on deformation as a result its effective resistance changes on deformation. A load cell has a rosette configuration consisting of four strain gauges in a wheatstone bridge configuration.

3.1.3 HX711 Module: The electrical signal generated by a load cell is very low in the range of millivolts (mV), so they need to be further amplified for better input values to the Arduino circuit. It is specifically designed for high precision electronic scale design with two analog input channels and an internal integration of 128 times programmable gain amplifier.

3.1.4 LCD Display: It is a high quality 16 character by 2-line intelligent display module with back lighting which can have various contrast settings. It works seamlessly with any microcontroller circuitry setup.

3.1.5 I^2C LCD Adapter: The adapter converts parallel based 16*2 character display into a serial LCD which can be controlled with just two wires making it easy to use with platforms that are too large to fit on-board.

3.2 Connections:

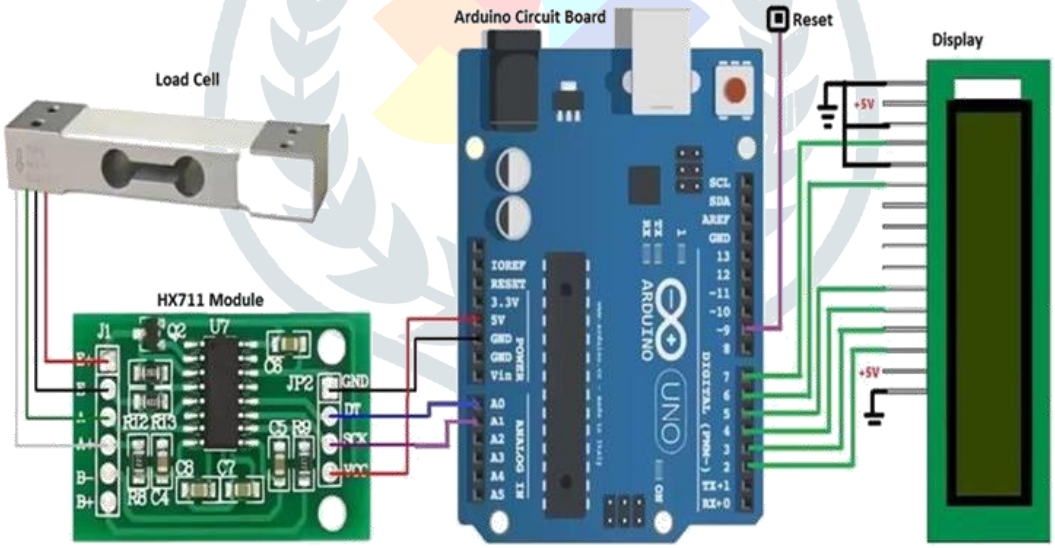

Fig 2: Diagram of Circuit Connections

Load cell to HX711

- Red to E+ (Voltage collector)
- Black to E- (Ground)
- White A- (Output signal)
- Green A+ (Output signal)

HX711 to Arduino

- GND to GND (Grounding Connection)
- DT to Digital Pin 4 (Digital Output to Pin 4)
- SCK to Pin 5 (Serial Clock Data to Pin 5)
- VCC to 5 volt (Power Supply)

Arduino to I^2C

- GND to GND
- VCC to VCC
- SCL to SCL (Clock Line to Synchronize Data)
- SDA to SDA (Data Line)

4. EXPERIMENTAL WORK

4.1 Prototype Model

Fig 3: Front View of Setup

Fig 4: Isometric View of Setup

For the load cell to function effectively, a cantilever beam setup has been fabricated so that the complete load will practically act on the load cell. The entire model has been made with plywood for ease of fabrication. The circuit connections are thoroughly insulated in the bottom, away from any fluids which could damage it.

4.2 Calibration: Upon developing the program, design factors needed to be considered for the thorough flawless functioning of the device. The system after fabrication of the entire setup was considered and accordingly calibration factors were used for perfect outcome.

5. OBSERVATIONS

Sl. No.	Fluid Poured (in L)	Value Displayed (in L)
1	0.5	0.5
2	1	1
3	1.5	1.5
4	2	2
5	2.5	2.5
6	3	3
7	3.5	3.5
8	4	4
9	4.5	4.5
10	5	5

The above tabular readings show the accuracy and precision of the system.

Fig 5: On Reserve Warning

As shown above in the figure, “On Reserve” value can be set in the program to warn the user to fuel up at the earliest.

Fig 6: Display of Measured Fuel

6. CONCLUSIONS

- System display the accurate value of fuel quantity digitally
- Approximates the distance which can be covered with the amount of fuel in tank.

With superlative calibration of the system, the required accuracy, precision and reliability has been achieved in measuring the quantity of fuel present in the tank and approximate distance the vehicle can travel before the tank is empty.

7. ACKNOWLEDGEMENT

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8. REFERENCES

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