

# **IoT Based Smart Fuel Meter**

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**Abstract:** *In recent days number of vehicle are increasing rapidly and specially most of the people are using fuel vehicle also the price of the fuel are continuously increasing now days, due to this most of the petrol pump owner cheated with there customer. When customer ask the petrol pump worker to fill the fuel pump then they will cheat with the customer by showing them wrong data or manipulating the fuel data. In order to counter this problem we have made a solution which will measure the exact amount of the fuel which filled into the tank and it will also show actual cost of the petrol which get filled in fuel tank. The proposed Smart Fuel Meter consists of a system for measuring the fuel quantity A mobile application is also provided that allows an end user to check the actual volume and cost of the fuel. This app will daily update the price of the fuel and the cost of the fuel will be calculated from the latest price of the fuel.*

**Keywords:** Internet of Things (IOT), ESP12E, Embedded System, Fuel meter, Fuel Fraud Detection

## **I. INTRODUCTION**

Now a days most of the vehicle having digital fuel meter but the main drawback of this type of fuel measuring system is that, this system indicates the level of the fuel in the form of bars, it doesn't show the actual value in numeric form so with the help of this type of system we can't determine that how much amount of fuel is filled into the tank.

Also in most of the fuel fraud or fuel tampering occurs when consumer fill the fuel according to price (like 50Rs, 100Rs) instead of volume (like 1 liter) because the price of the fuel are changes on daily basis so for convenient user ask fuel pump owner to fill the fuel like 50Rs or 100Rs and in this case the fuel pump owner will cheated with the consumer by filling less amount of fuel, because most of the consumer doesn't take care of it that's why most of the fuel pump owner cheated with the consumer in this way.

So for detecting above types of fuel fraud we have designed an IoT based smart fuel meter which determine the volume of the fuel and it will send the value of fuel volume on a customized android app, also this app will daily update the price of the fuel and based on this updated price of the fuel, this app will show the cost of the fuel on display along with the quantity of the fuel.

## **II. LITERATURE REVIEW**

[1] "Real Time Fuel monitoring and Theft Detection System using IoT", in this paper the author have proposed a solution which detects the fuel tampering and also it will detect the fuel theft This system will store the data of the petrol on firebase database and then it will send this data to the android app which is designed for this.

[2] "Fuel Theft Detection Location Tracing using Internet of Things", This system can detect the fuel fraud, fuel theft and if the petrol level is low then system will also alert the consumer and it will plots its location in google map, so that the user can see the nearest fuel pump in map. This system will store the data of the petrol on firebase database and then it will send this data to the app which is designed for this.

[3] "Digital Fuel Measuring System with Distance to Zero and Fuel Fraud Indicator" This system will measure the value of the fuel which is present in the fuel tank using float sensor. If the consumer will fill the fuel then before filling the fuel consumer will check the actual amount if the fuel which is present in the tank and if the fuel pump owner trying to cheat by filling less amount of petrol then the consumer will see the actual value of the fuel which get filled into the tank by this system.

[4] "Vehicle Fuel Theft Detection and Monitoring System", This paper presents about the fuel theft system. If consumer have parked his vehicle in somewhere and if anyone try to stole the fuel from the tank then the ultrasonic sensor will detect

the change in fuel level and the system will generate sound from the buzzer. Also when fuel theft is occurred then system will send a message to the registered phone number of the consumer.

[5] “Fuel Theft Detection System” This system is based on PIC 16F877A microcontroller. If consumer have parked his vehicle in somewhere and if anyone try stole the fuel from the tank then the IR sensor will detect the change in fuel level and the system will generate sound from the buzzer

[6] “IoT Based Smart Fuel Monitoring System” This system consist of ATmega16 IC and for sending the volume of fuel to the server it uses ESP8266 chip. When data is successfully sent to the database then this amount of fuel will get display on a android app.

[7] “Digital fuel level indicator in two-wheeler along with distance to zero indicator” This system consists of a float sensor, PIC16F microcontroller and LCD display. This system will calculate the amount of the petrol by the float sensor. This sensor will also calculate the milage of the vehicle and based on that this system will predict the time for which the remaining amount of petrol is sufficient .

[8] “Embedded System Based Intelligent Digital Fuel Gauge” First of all this system will calculate the amount of the petrol which get filled into the tank and it will print this amount in LCD display. After it this system will send a message (by using GSM module) to registered mobile number of the consumer, this message consist of the amount and cost of the petrol which get filled into the tank and also the location and time in which the fuel get filled into the tank

[9] “Digital Fuel Indicator in Two Wheelers” This system consist of a load cell for calculating the amount of the fuel in the tank. Once the amount of the fuel get determined then this amount will get print on the seven segment display. For controlling purpose this system consists of PIC microcontroller.

[10] “GSM Based Digital Fuel Meter and Fuel Theft Detection using PIC Microcontroller” This system will calculate the amount of the petrol by using float sensor. After that it will show the accurate analog value of the fuel which is available in the tank. When someone try to stole the petrol from the vehicle then the buzzer will generate the sound and the system will send the message to the registered phone number of the consumer.

[11] “Low Cost Intelligent Real Time Fuel Mileage Indicator for Motorbikes”. This project focuses on creating a device which can help to actively display the fuel mileage of a motorbike in real time. It involves the making of the system to provide a mileage indicator.

[12] “Design and development of digital fuel meter indicator for 2 wheelers splendor vehicle”. In this system flow sensor is combined with float sensor and by using it the actual value of the fuel is obtained. By using flow sensor the fuel tampering get detected

[13] “Fuel measurement Using Load cell” this system consists of a load cell and by using load cell this System calculates the weight of the fuel and after that by using the GSM module this amount of fuel is sent to the user phone via sms.

[14] “Model Based Design of Digital Fuel Indication System”, In this system user proposed a system which calculates the level of fuel by using ultrasonic sensor and after this the value of the fuel gets printed on a 16by2 LCD display.

[15] “Real Time Fuel Estimation using Micro Controller and Android App” This system will first detect the level of the fuel by ultrasonic sensor and then it will send this value to the android phone by using Bluetooth module. This android app can also show the location of fuel station by using google map.

[16] “Fuel Level Indication and Mileage Calculation using IoT” This system calculate the level of fuel by using ultrasonic sensor and flow of the fuel by using YFS201 flow sensor after that value of the fuel filled and the available fuel's value get send to the blynk app which display these values.

[17] “Digital Gasoline Indicator which shows accurate fuel/Gasoline in the tank” This system can determine the accurate value of gasoline as well as fuel (petrol/diesel) after that it the data will be send to the SQL server.

[18] “Smart Fuel Metering System” In This paper author proposed a system which consist of a flow sensor and 16by2 display. In this system flow sensor will first calculate the volume of the fuel, And then this value of the fuel gets printed to 16by2 display.

[19] “IoT based Smart Vehicles for Fuel Consumption” This system consists of a load cell, GPS module and GSM module. This system will calculate the weight of the fuel which is present in the tank and then this values will get send to the database. For sending the values to the database this system use GSM module.

[20] “GPS-GSM Based Vehicle Monitoring & Smart Fuel Measurement System” This system use Ultrasonic sensor , GPS module and GSM module. This system calculates the level of fuel by using ultrasonic sensor and after it this value send to the user’s phone via SMS. For sending the SMS this system use GSM module.

### III. SYSTEM DESIGN AND IMPLEMENTATION

#### 3.1 Working of Smart Fuel Meter

1. We have supply the system with two 3.7V Li-Ion Cell through IC7805 Voltage regulator. The signal pin of YFS201 flow sensor is connected with ESP12E chip.
2. When fuel flows through YFS201 then the signal pin of YFS201 will send a high pulse to the ESP12E chip and we have programmed ESP12E chip such that it will count the number of high pulse of YFS201 in a particular time interval and based on this number of count it will first calculate the flow rate and then volume of the fuel.
3. When the ESP chip calculates the volume then it will send this value of quantity of fuel to the google firebase database and from here this value is fetched by the android app.
4. The android app takes daily updated price of the fuel from the “Daily Fuel Price API” which is an API in Rapid API platform.

Now by using this updated value of fuel price, the android app will show the total cost of the fuel along with the volume of the fuel which get filled into the fuel tank.

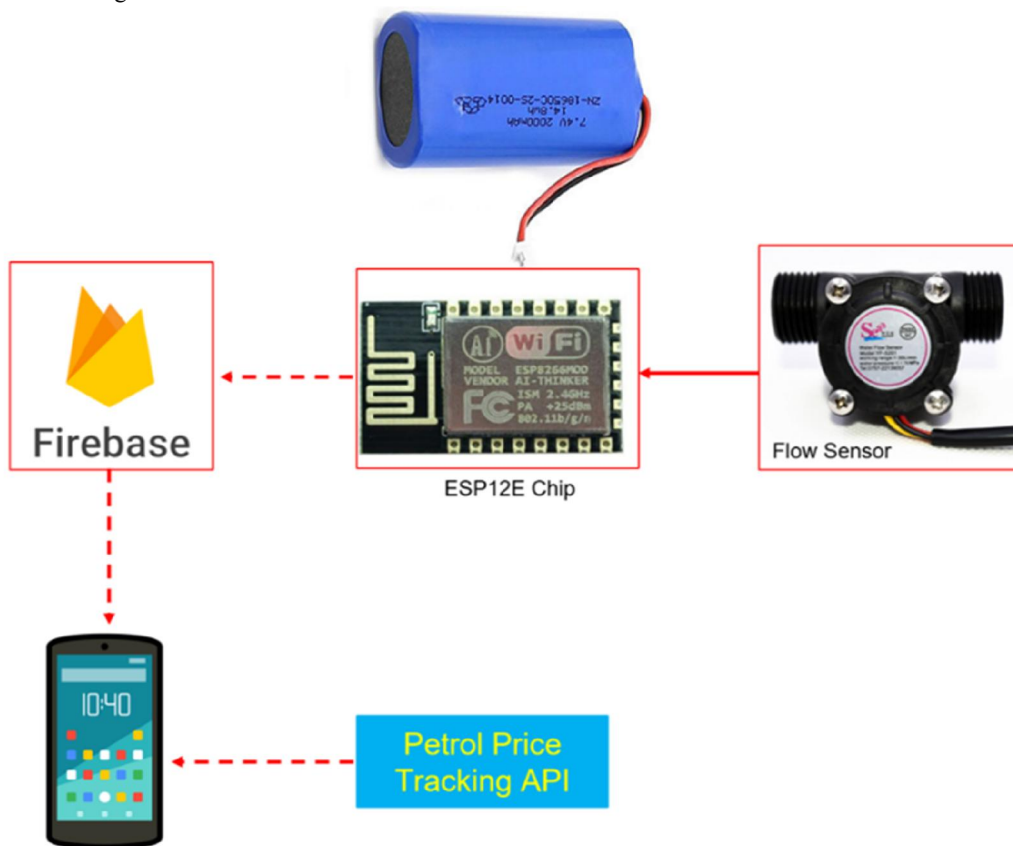
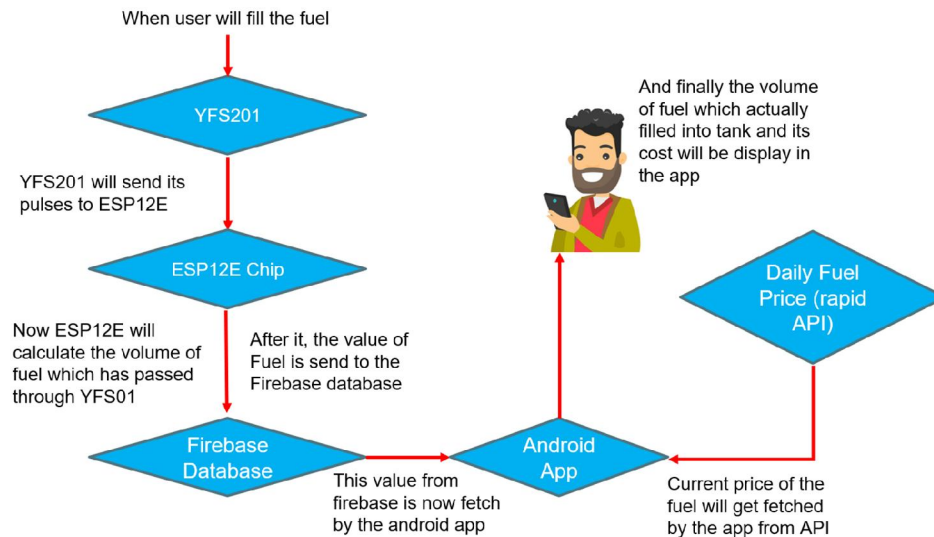


Figure 1: Block Diagram of Smart Fuel Meter

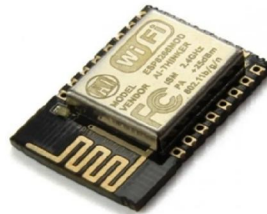
#### IV. FLOW CHART



**Figure 2:** Flow Chart of Smart Fuel Meter

#### VI. SYSTEM DESCRIPTION

##### 6.1 ESP12E Microcontroller



**Figure 3:** ESP12E Microcontroller

ESP12E is developed by Ai-thinker team. It is a miniature microcontroller with inbuilt wifiSOC .ESP12E/ESP8266 is programmed by using Arduino IDE .We can program this board using C and Micropython languages. This board does not have any USB interface so we have to connect a FTDI programmer for programming this board. ESP12E board supports clock speed of 80Mhz and 160Mhz.We can use this microcontroller as Access Point(AP) or Station(STA) mode or Both(AP+STA) simultaneously.

- Operating Voltage- 3.0V to 3.6V
- GPIO pins- 10
- Communication Protocols- SPI, UART, I2C, I2S
- Memory- 36KB RAM, 4MB Flash Memory
- Wireless Communication Standard - 802.11 b/g/n

##### 6.2 YFS201 Flow Sensor



**Figure 4:** YFS201 Flow Sensor

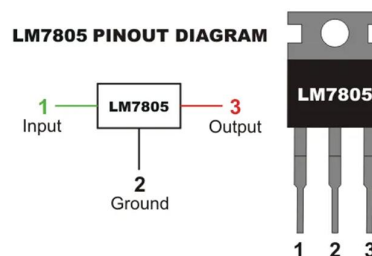
YFS201 determines the flow rate of any liquid. This sensor works on hall effect. It consists of a turbine wheel and a magnet is attached with this turbine, when liquid is passed through it then this wheel rotates and due to the magnet hall sensor generate high pulses, so by using this high pulse ESP12E chip calculates the value of flow rate and volume.

### 6.3 7805 Voltage Regulator IC

The voltage regulator IC 7805 is actually a member of the 78xx series of voltage regulator ICs. It is a fixed linear voltage regulator. The xx present in 78xx represents the value of the fixed output voltage that the particular IC provides. For 7805 IC, it is +5V DC regulated power supply. This regulator IC also adds a provision for a heat sink. The input voltage to this voltage regulator can be up to 35V, and this IC can give a constant 5V for any value of input less than or equal to 35V which is the threshold limit.



**Figure 5:** LM7805 Voltage Regulator IC



**Figure 6:** Pinout of LM7805 Voltage Regulator IC

### 6.4 Firebase Database

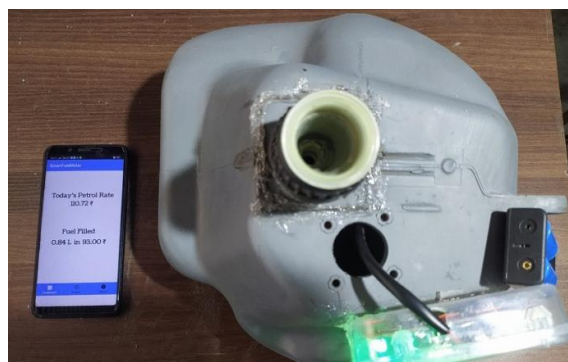
Firebase is a platform developed by Google for creating mobile and web applications. It was originally an independent company founded in 2011. In 2014, Google acquired the platform[1] and it is now their flagship offering for app development. Firebase provides tools for tracking analytics, reporting and fixing app crashes, creating marketing and product experiment.



**Firestore**

**Figure 7:** Firebase Database

## VII. TEST RESULT



**Figure 8:** Final testing

In the above picture of demonstration we have tested the working of our system. We have passed water through flow sensor which is installed inside the fuel tank and the volume and the cost of the fuel gets displayed in android app.

### VIII. CONCLUSION

The paper gives an overview about detecting and fuel tampering the fuel fraud using embedded system and IoT technology. It gives an brief idea about all the components, tools and platform which we have used for this system. It also specifies all the steps which we have took for this system so far. This system is accurate for measuring the fuel quantity and it calculates the cost of the fuel on the basis of latest price of the fuel i.e. it calculate the fuel in real-time. We have designed this system user friendly so that every consumer can use it easily.

### VI. FUTURE ENHANCEMENT

We have installed the flow sensor inside the fuel tank which made this system little bit complex and uncompact so one major future upgradation for this system is that we can make the whole system compact so that its complexity gets reduced and every consumer can easily installed this system in their vehicle with their owns.

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