

# IoT Based Fuel Monitoring and Tracking using Node MCU

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**Abstract**— Fuel Management System (FMS) requires designing, implementation and characterization of a hardware and software for vehicles. The primary design goal is to devise a system capable of monitoring the fuel level in real time. This system is based on hardware as well as software. The hardware part consists of fuel level circuits, on-board Raspberry-Pi, GSM and GPS modules. This system offers an Automatic Electronic System (AES) which replaces manual monitoring of fuel. This system measures fuel volume and sends measured volume to the owner's mobile as well as owner's computer through GSM network. Through which it can be read anytime and anywhere with the web application. From the web application the user will come to know about their car efficiency, mainly how the fuel is being consumed at various factors like increase in speed, worst road conditions, engine getting heat after long time, frequent change of gear, during traffic, not having proper maintenance, also due to some bad petrol/diesel/oil in which the fuel is consumed more and it will give less mileage. It also provides a technique for detecting theft or fraud incidents in case of fuel theft or fuel leakage. Additionally the system can track the location of each vehicle in order to locate the place of any incident of theft or leakage that could have occurred.

**Keywords:** Node-MCU (ESP8266 Wi-Fi), Fuel Level Indicator, Monitor, Fuel Gauge

## I. INTRODUCTION

Fuel Management Systems (FMS) are used to maintain, control and monitor the fuel consumption in any type of vehicle that uses fuel. It can be also installed in power plant such as steam power plant where the fuel level indicator is required. Currently the organizations are facing a serious problem of managing the fuel transportation due to manual monitoring. There are many flaws in the manual monitoring such as the driver does not know whether the amount of fuel inserted in the fuel is the same as the amount declared on the fuel indicator at the fuel pump and commit fraud by falsifying information regarding the amount of fuel inserted. Owners of the vehicle must keep all the above mentioned factors into account, therefore the need for an automated electronics system (AES) that not only checks the fuel ingested but also digs out the theft of fuel in order to save owner from loss of fuel but also it monitors the fuel level and keeps the record of the fuel efficiency and maintenance of the vehicle. Furthermore, this system provides an efficient way of tracking vehicles. The database contains the number of fuel liters at the time of insertion and number of fuel thefts when the volume of tanker changes a lot before reaching the destination.

The goal of the Internet of Things (IOT) is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service. With the help of AES we are able to provide In-vehicle feedback systems are a relatively new approach to encouraging driver behavior change for improving fuel efficiency.

## II. PROBLEM STATEMENT

Lack of knowledge of exact quantity of fuel in vehicle, So owner or operator has to estimate the quantity by assumption and sometime theft of fuel at the refueling station (By unfair means) is also creates problem. To maintain and manage fuel consumption of vehicles in big firms and travel agencies is a tedious work to be done manually and Bad road conditions leading to leakage of fuel due to damage.

## III. PROPOSED SYSTEM

The proposed system has an ability to accurately measure the Mileage of the car from the database that is available on the web application, by which the users are able to interpret their car's Mileage, speed, fuel consumption and finally time for maintenance. They also know the difference between before maintenance and after maintenance of the car. It will be easy for the user to get the accurate measures instead of using meter. The main functions of the project are to collect the mileage calculating factors through sensors and through wireless network send those values to the module to the database.

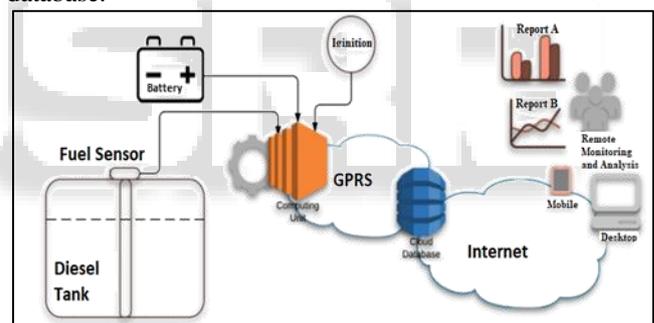


Fig. 1: Architecture Diagram for fuel efficiency monitor

### A. Scheduled Fuel Filling

Even a regular vehicle user, do not know as when to fill the fuel for the vehicle as and because one use to fill it by weekly or daily basis. And now particularly for a new person it becomes a difficult task to identify the level of fuel. So it becomes a customary problem for a long traveller. Here an experimental work has been carried out to suggest equation to predict the time of filling based on the "distance basis".

### B. Fuel Theft

Almost all of the public have their own vehicle. Now-a-days fuel theft is happening in the parking and vehicle security becomes a challenging thing. In practice by today no record of data is being maintained for fuel filled and its consumption value. To overcome this challenging problem a fuel monitoring system is being implemented. This task is being carried out by the use of embedded system based on Global System along with mobile communication technology. A system has been developed in which is fuel theft occurs, the system reports automatically via GSM module by sending SMS message to owner/driver of the vehicle.

### C. Economic use of Fuel

While driving with normal speed the driver knows the amount of fuel remaining but he doesn't know how much distance can be travelled with the remaining fuel. By implementing the fuel consumption system it will provide the driver with the information about things like the time to fill the vehicle with fuel and also provide with an idea about the estimated distance to which the vehicle can travel with the available amount of fuel.

## IV. SYSTEM REQUIREMENTS

- Fuel Tank
- Node MCU (ESP8266 WIFI)
- Fuel Gauge
- Database

## V. METHODOLOGY

- 1) VEHICLE SPECIFICATIONS
- 2) Vehicle Type- 2 Wheeler
- 3) Manufacturing Company- Hero Moto Corp
- 4) Vehicle Model- Hero Glamour
- 5) Engine Type- Air cooled, 4 - stroke single cylinder OHC
- 6) Mileage- 81.1 kmpl
- 7) Compression Ratio- 9.1:1
- 8) Ignition- DTSI
- 9) Fuel Tank Capacity- 13.6 Liter

The proposed system allows the user to identify the exact amount of quantity of fuel in the fuel tank. Our goal is to eliminate the analogue level system to discrete quantity measurement.

### A. Hardware Design

- 1) DATA ACQUISITION- The purpose of this unit is to detect (sense) the fluid level using ultrasonic sensor.
- 2) DATA PROCESSING

Node MCU: This is the most important unit and the core of the system. It handles all the processing and controlling needed for system to function. It receives the sensing information, processes it, returns the corresponding values, and generates the necessary controls to guide the data to the desired destination.

- 3) POWER UNIT- A wall adapter or a USB port can also be used to charge Li-Ion/Li-polymer batteries. The recommended input voltage is 5V, and the recommended input current is 2A.

## VI. WORKING

The working of this device requires specific hardware and software. The software contains certain programs. These programs execute on input of certain sensors. The sensors sense the level of fuel in the tank, and the output is given to node MCU. The output from the level sensor shows some physical parameter which is used to detect accurate amount or quantity of fuel in the tank. Then the computed amount of fuel is displayed on the screen and it is stored in the data acquisition system. In case of theft or leakage the level sensor sense the abrupt change in the level in the fuel tank. Thus estimating the present position of the vehicle if in motion detects as leakage, and if stationary detects as theft. The

stored data can be transferred to various systems for further analysis of the system, where IOT comes into the picture.

## VII. LITERATURE REVIEW

### A. Fuel Management System

Areeg Abubakr Ibrahim Ahmed, Siddig Ali Elamin Mohammed, Mohamed Almudather Mahmoud Hassan Satte. Department of Electrical and Electronics Engineering University of Khartoum Khartoum, Sudan In this paper the author describes that the fuel management system is a monitoring device built on the Raspberry-Pi computer, it takes information about tank's fuel level in real time through its sensor and live streaming of the site, then uploads it directly to the internet, where it can be read anytime and anywhere through web application. The bits referred from the above paper are IoT architecture and general methodology and understanding of various sensors.

### B. Fuel Monitoring and Vehicle Tracking

Sachin S. Aher, Kokate R. D. International Journal of Engineering and Innovative Technology (IJEIT) Volume 1, Issue 3, March 2012 This paper deals with today's world, actual record of fuel filled and fuel consumption in vehicles which is not maintained. It results in a financial loss. To avoid this we are implementing a microcontroller based fuel monitoring and vehicle tracking system. The bits referred from the above paper are GPS technology and fuel management. This paper gives a broad idea regarding the management of fuel in huge firm or companies with many vehicles.

### C. Automatic Fuel Tank Monitoring, Tracking & Theft Detection System

Komal D/o Shoukat Ali Khuwaja, Brohi Arif Ali , Vlad O. Mihalca and Radu Cătălin Țarcăl MATEC Web of Conferences 184, 02011 (2018) Annual Session of Scientific Papers IMT ORADEA 2018. This system is proposed for fuel carrying road tankers which carry fuel from oil depots to end users such as petrol-stations. This system is based on hardware as well as software. The hardware part consists of fuel level circuits, on-board Arduino, GSM and GPS modules. It also provides a technique for detecting theft or fraud incidents in case of fuel theft or fuel leakage. The point referred from the above paper is regarding the fuel theft in the oil tanker. The device is minimized to an extent which can be used in an automobile for theft and leakage detection from the fuel tank.

### D. IoT Based Fuel Efficiency Monitoring System using Raspberry Pi

S. Rohini, B.Umamaheswari, K.Ramya, L.Sharmi, R.Vishnupriya, M.Rajalakshmi, Dr.S.Padmapriya. International Journal for Technological Research in Engineering Volume 4, Issue 8, April-2017 The IOT based fuel efficiency monitoring system is for four wheeler, aimed at the improvement of efficiency in four wheeler especially in car. From our application, the user will come to know about their car efficiency in the graphical format. Mainly how the fuel is being consumed at various factors like increase in speed, worst road conditions, engine getting heat after long

time ,frequent change of gear, during traffic ,not having proper maintenance, also due to some bad petrol/diesel/oil in which the fuel is consumed more and it will give less mileage .In some cases the according to the driving and other factors the fuel is less consumed and mileage is give more .To find all this this system helps to track their mileage with the help of speed sensor and terrain sensor. From tracking the mileage the user will come to no about their cars efficiently properly and maintenance of the car is easy. Through our website the user can view their mileage graph .The graphical view makes the user to understand better. From this the proper analysis is made and maintained properly. The point referred from the above paper is deep knowledge regarding Raspberry Pi and web based application regarding the efficiency and maintenance of automobile.

#### VIII. CONCLUSION

This paper developed a fuel management system that measures tank's fuel level to be displayed through web based application and design of camera surveillance system for station. At the same time this management system can store the transaction information in the database that can generate daily, weekly, monthly and yearly business report. This system is more efficient, reliable and cheap compare to existing system. In addition, the system has been successfully designed to operate independently of the power grid, by utilizing solar panels. These panels additionally charge the system's batteries so that it remains powered at night or during cloudy days. The system employs two different sensors: The ultrasonic sensor, and the chemical Etape. Although cheaper than the latter, the results produced by the ultrasonic sensor suffer from inaccuracies caused by the gasoline thick vapors. The chemical Etape, being more expensive, resolves this issue and possesses a higher resolution.

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