FUEL LEVEL MONITORING AND FUEL THEFT ALERT SYSTEM – A REVIEW

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ABSTRACT:

In today's world, it is necessary to monitor the systems which we use. Anything can happen at any time and cannot blame the others. Especially when it comes to fuel, it has become as a resource in demand. So it's important to safeguard people from the threats taking place to steal fuel. The fuel level monitoring system enables user to keep track of current fuel level with any previous updates and alerts user if there is a drastic change in level which in turn can reduce the fuel thefts and the cost it takes to refill it. Even user can cross check whether in gas station they fill correct level of fuel in our fuel tanks. As almost everything is automated the system uses the IOT to implement this process.

KEYWORDS: *Internet Of Things (IOT); Microcontroller; Float Sensor; Arduino; Gsm; Fuel Level Sensor.*

INTRODUCTION

In current times, petrol is a limited resource. As a result fuel prices increase every day. It has become difficult for the average humans to keep up with the increasing prices of fuel every day. This system also helps to avoid cheating of customers from fuel filling station owners. This system assures the security and monitors the fuel level in the fuel tank. Fuel theft from vehicles is one of the main concerns of many bike and car owners. Some people realize fuel theft from their bikes or cars that has been stolen. Some are unaware about the fuel theft. Irrespective of the fuel theft, it is also life threatening for the owner of the vehicle.

To avoid such problems Digital Fuel Meter and anti theft system should be implemented in vehicles. The earlier proposed system used the microcontroller as the main part which sends the message to the owner by using the GSM module when the theft occurred and also buzzer will ring an alarm to indicate fuel theft. This process is accurate and secure. Some other systems follow the GSM based vehicle fuel theft detection system

with SMS notification for car, bikes, and all other vehicles to detect fuel theft. While implementing the model, these systems have used telecommunication, with improved SMS integration and a communication between machine and human is achieved.

REVIEW OF LITERATURE

This paper reviews existing fuel monitoring smart devices and systems which can be used to limit or stop unauthorized access to the fuel tanks. Srinivas. M et.al [1] implemented to indicate fuel level by using Ultrasonic sensor and Flow sensor. The process was started when the key was being inserted, then the sensor would start the work and check fuel level in the tank. In the circuit 9v, 2A SMPS (switched mode power supply) was used to give power supply to all the components which take 230 input from the main supply and convert it into 9v.The Arduino in built voltage regulator will convert 9v to 5v. When power was on, microcontroller measures the fuel level and displays it on the LCD. It also showed the ignition ON and OFF condition. If the fuel level was above the range, the message will not be sent to the owner. Else, the message will be sent to the owner and immediately the buzzer is ON. To display the fuel level, LCD was used. GSM module was used to send SMS to alert the user about fuel theft.

HedaVenkata et.al [2] proposed a project for fuel indication and fuel theft. In this a Level Sensor was used to detect the fuel level in the fuel tank. And if the fuel level goes below a certain threshold then the sensor gives a signal to the microcontroller which needs only a 5V power supply which was taken by solar panels. Then the buzzer was turned on by the microcontroller and sent a message to the car/bike owner .Since this system uses solar panels, energy is being saved and in the long run, solar power is economical.

Mr.Aniket Shinde et.al [3] had projected an idea of Fuel level detection system in which an ignition key was additionally added to the working model. In this a Level Sensor is turned on only when the key is removed from the ignition lock and whenever the bike/car key was inserted into the ignition lock and switched on, at that time a signal is given to the microcontroller. This means that once the person gets out of the car the monitoring system is being activated. Here the Fuel level sensor sends a signal to the Microcontroller which in turn indicates the Buzzer to ring. Then this information was sent as SMS to mobile. This message is sent through the GSM module which has a unique IMEI number (International Mobile Equipment Identity) by which the location of the theft is also detected. To monitor the fuel level in vehicles Rajesh Krishnaswamy et.al [4] implemented a model using IOT. The objective of this proposal was to control fuel theft and also it indicated user about the level of fuel filled by petrol bunks. Whenever the fuel level changes it was indicated to the user.

The proposal consists of 3 modules namely an inserted framework module, GSM communication module and GPS following module. The framework module got data from vehicles, records it and sends messages through a communication module. Whenever there is a drastic change in fuel level, the sensor got activated and a signal was sent to the user/owner by sending a message through GSM modules. The float sensor was used considering the size of fuel tanks in vehicles. Since GSM is accessible in all region and as it is specially created to put an impression on a particular number was highly recommended in this proposal. The fuel management system (FMS) is generally used but it is tedious as manual checking is needed instead of that GSM was used. The Arduino microcontroller (Mega 2560) which supports more memory was used. To calculate a tanker volume distance sensor was used. The GPS following module was used to keep track of ongoing changes in fuel tankers. The added advantage of this proposal was that along with monitoring fuel level it also used a fuel indication system. This model required only minimum cost and it can be implemented in all vehicles.

To monitor the fuel level and alert if any change happens Jaiharish.M et.al [5] developed this system using IOT. The system monitored the fuel level in vehicles irrespective of place and updated the information automatically. The main objective of this system was to reduce fraud in refueling station and fuel identification using (IOT). The fuel level float sensor was used to monitor the fuel tank. Then an analog signal from the voltage circuit was obtained. This signal was sent through the analog input ports to the Raspberry pi microcontroller. The raspberry pi in turn read the input from the sensor and gave the output.This output from the microcontroller was the input of the actuators. The GSM module gave an alert to mobile applications. Also through the LCD display fuel level was shown. By this implementation fuel theft and range of fuel level was monitored and alerted successfully.

Kaivalya Kulkarniet.al[6] executed this fuel system using Raspberry Pi to compare the fuel level in the tank. The Raspberry pi was connected to the GSM/GPRS module. The voltage obtained from the fuel sensor was given as input to single channel ADC 0804. This converted an equivalent analog input voltage to the corresponding 8-bit digital output. These pins are connected to 8 Raspberry pins. The buzzer was directly connected to Raspberry Pi. When the system was ON, the Raspberry Pi stored the first value of the fuel level as the reference value. Whenever a false decline in fuel level occurs, the resistance of the fuel level sensor gets changed by the corresponding analog voltage obtained from the sensor. Raspberry pi converted this 8-bit binary output into an equivalent decimal format and compared it with reference value. If the difference exceeded the threshold value the buzzer was switched on. Then, Raspberry pi transmitted commands to the GSM module. It sends SMS/Call to the specified mobile number. After the SMS request, the current value of fuel became the

reference value of Raspberry pi and again the process was started. This idea of implementation opens new avenues for safeguarding fuel from theft and has a wide range of applications. Thus, this project assured the owner of complete protection of fuel and the automobile considering the future aspects. To make a significant contribution in the development of an automated system for fuel tank level monitor and mobile tracking Daniela Popescu et.al [7] put forth this article. The main objective of this paper was based on development and testing the process of designed a system to control fuel tank level, location management and mobile tracking and data report creation for specific tasks. The installation of a volumetric sensor in the fuel tank is the secondary objective. The development of software automated systems supported smart control in the fuel system kept track of fuel economy and emissions and much more. The fuel level sensor was placed in the fuel tank and it was used to monitor in mobile and stationary units. The energy for the circuit was supplied from a (12-24V) battery .The fuel level sensor was placed in the vehicle and connected to a control unit. Data transfer was done by a (BLE) Bluetooth Low Energy channel. GPS machinery tracking was used to indicate drains/accidents related to fuel tanks. Machinery location management was achieved with a support map through web connection. On testing, the main findings gave fast tracking of machinery movement and fuel level status. Fuel consumption was found from the Initial Fuel Level (IFL) evolution curve recorded in an electronic database. This gives the accurate level of measurement inside the fuel tank and prevention of fuel leaks. The accuracy of the fuel level sensor and computability was an added advantage to this project. The actual findings from the monitoring system are an asset for engineering endeavor validation.

A.Avinashkumar et.al [8] have proposed a system revolutionized the area of fraud detection and fuel monitoring system using Arduino and a ultrasonic sensor. It was fixed to find out the fuel level and it also gave the present fuel level inside tank and fuel filled at that point and total fuel level after filled inside the tank .using this fuel filling fraud could be controlled.

Vijayakumar P et.al[9] have projected an idea of Fuel level monitoring system in which the fuel filled into the tank through the inlet which passed the flow sensor , measures the amount of fuel being filled into the tank and pass this information to the Atmega16 microcontroller which in turn displayed the output on the LCD screen. The load sensor located at the bottom of the fuel tank reads the amount of fuel present in the tank at any given time which was sent to the microcontroller. When the fuel was consumed, it leaves the tank through the outlet where another flow sensor measures the amount of fuel consumed. The microcontroller collected all the information and then analysed the fuel consumed. The raw and analyzed data was sent to the cloud and user's mobile through the Wi-Fi module. In this way the user got accurate details of fuel usage.
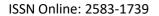
Naomi Somer Lepcha.et al [10] implemented the fuel theft detector using a microcontroller. To communicate between the microcontroller and mobile phones, the GSM module was used through Universal Asynchronous Receives-Transmitter(UART), which is an IC used for serial communications through a computer or peripheral device serial port. This system needs three basic signals to communicate over UART namely receive, transmit and common ground. Text messages can be sent through a model by interface the three signals like Transmit (TXD), Receive (RXD), Common ground (GND). The transmit signal of the serial port of the microcontroller was connected with the TXD signal. Same as, the receive signal of the microcontroller serial port was connected with the RXD signal. The microcontroller commanded the GSM to send a message and alarm was started by the buzzer installed within the system which in turn indicated the fuel theft. The sensor was also connected to a microcontroller. When the sensor was obstructed, and became active low, the message was sent to the mobile number which was loaded into the microcontroller and the buzzer started ringing.

To avoid problems faced by people in fuel theft at petrol pumps Mrs.S.A.Chiwhane et.al [11] implemented a system such that it monitored current fuel level using flow sensors. When fuel was filled in the tank the flow sensor gets activated and provides pulses that are converted to liters and sent to the ESP8266 soc where data gets stored and sent through Wi-Fi setup to server (cloud server). The server sends it to the application. The user was located through GPS by the application. The results showed that it calculated the current fuel filled in the tank. Also this system used ESP8266 which reduced the cost. The limitation of this system is chances of delay in transformation and representation of information due to slow internet access.

R Aravindet.al[12] introduced this system by using Arduinouno. To regulate the voltage level, they have interfaced the load cell to the Arduinouno through amplifier. They also interfaced the GSM and GPS module to the controller to send the fuel level to the owner. When a vehicle entered into the petrol station, the button was pressed; the load cell measured the initial amount of fuel and sent it to the controller. The controller saved the initial amount of fuel. The added level of fuel was calculated by subtracting the initiallevel from total level. This was calculated by a load cell which was displayed in the dashboard and sent the SMS of the added level of fuel to the owner. It contained where the fuel was added and location of vehicle through GPS module. The output was displayed in Liquid Crystal Display (LCD) attached to the output port of the controller. The GSM and GPS module are interfaced through the I/O ports of the controller. This system measured the fuel level and displayed it in the dashboard and also an SMS alert was sent to the owner. Performance analysis of fuel level monitoring and fuel theft alert system is shown the table 1.

TABLE 1: PERFORMANCE ANALYSIS OF FUEL LEVEL MONITORING

AND FUEL THEFT ALERT SYSTEM

S. N O	AUTHOR	YEAR	METHOD USED	BENEFITS
1	Srinivas .M et.al [1]	2020	Arduino with ultrasonic sensor technology.	Alerts the user about fuel thefting.
2	Hedavenkata Et.al [2]	2018	Microcontroller with solar panel technology.	Indication of fuel level and fuel theft.
3	Mr.AniketShinde et.al [3]	2019	Microcontroller with ignition key and GSM module technology.	The location of the theft is also detected here.
4	Rajesh Krishnasamy et.al [4]	2019	Arduino microcontroller with GSM technology.	Controls fuel theft and also indicates to the user about the level of fuel filled by petrol bunks.
5	Jaiharish.M et.al [5]	2019	Raspberry pi technology with GSM technology.	Prevents fraud in refueling stations.
6	Kaivalyakulkarni Et.al [6]	2019	Raspberry pi technology.	Safeguarding fuel from theft.
7	Daniela popescu Et.al [7]	2020	Fuel level and volumetric sensor with BLE technology.	Optimization of time and geo location of refills and prevention of fuel leaks.
8	A.Avinashkumar et.al [8]	2014	Microcontroller with level sensor technology.	Controls the fraud at the filling station.
9	Vijayakumar P et.al[9]	2019	Microcontroller with GSM module technology.	The user gets accurate details of fuel consumption and usage.
10	Naomi Somer Lepcha.et al [10]	2015	Microcontroller with UART technology.	Informs the user about the fuel theft.
11	Mrs.S.A.Chiwhane et.al [11]	2017	ESP8266 with GSM technology.	Monitors fuel level using ESP8266 which reduces cost.
12	R Aravind et.al[12]	2018	Arduinouno with GPS and GSM technology.	Measures the fuel level and informs users in case of theft.

CONCLUSION

Fuel theft is common these days since thieves find it easy to sell and use stolen fuel. It is also a frequent target to steal fuel from cars and trucks. Standard mechanisms such as use of fuel caps are not very much effective since a thief can still puncture the tank and steal fuel and leave the car in an increased damaged state. Considering the cost of damages and losses, fuel monitoring and anti-siphoning smart devices can limit or stop malicious access to users' fuel tanks. A fuel monitoring device would help to track all the current levels and also give timely updates on the fuel amounts getting into users tanks. This system is used for preventing fuel theft and also it displays the available fuel in the tank. The system looks very small and compact and that can be mounted on vehicles easily and it's applicable for all types of vehicles like car, bike etc. which can be set in Customer's vehicle so that they can't be cheated by the fuel filling station.

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